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PROCEEDINGS

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CONTENTS OF VOLUME III (NEW SERIES).

ART. I.—*Notes on West Australian Oology, wi*
Descriptions of New Eggs.

(With Plates I and II.)

By A. J. CAMPBELL, F.L.S.

(Communicated by PROFESSOR W. BALDWIN SPENCER,

[Read March 13, 1890.]

Having recently devoted myself to nearly four m of scientific research, particularly with reference to work, in Western Australia, I desire to lay before Society the following oological notes. Further, at juncture, the notes may be deemed the more val because the "West Australian Constitution Bill," now l the Imperial Parliament, is directing attention to the western territory, from whence any knowledge is of pe interest at present.

Astur cruentus, Gould (West Australian Goshaw Eggs roundish in shape, bluish-white, with dull sı In a clutch of two, one specimen possesses a few sm of reddish-brown. Dimensions—(1) 4·4 x 3·46 (2) 4·33 x 3·43 cm. These examples are from the Chaı Bay District. I did not take them personally, but ha doubt of their identity. Gould states that this gos breeds during October and the two following m making a nest of dead sticks on the horizontal fork mahogany (*Eucalypt*) tree.

Podargus brachypterus, Gould (Short-winged Poda —Eggs pure white, long oval in shape; texture of shel with slightly lustrous surface One example, from a of two, measures 4·44 x 2·96 cm. They were takeı October with the nest (a thick platform of twigs, &c.), 10 or 12 feet from the ground, in a paper-bark *(Melaleuca)*, at Quindalup. This podargus som places its nest in the fork of a grass tree *(Xanthorrha* well as in eucalypts. Dimensions of nest about 25 diameter, by about 5 cm. in thickest part.

Strepera plumbea, Gould (Leaden-coloured Crow-shri A pair of eggs I took at Hamelin Harbour are of the

longish form, deep reddish-buff or brown, marked over the whole of the surface in an indistinct manner with a darker colour. Dimensions—(1) 4·53 x 2·97 cm., (2) 4·67 x 2·97 cm. Clutch usually three eggs. A specimen from the Champion Bay District is much lighter in colour, resembling those of *S. fuliginosa* of Tasmania, with smaller dimensions, namely 4·25 x 3·07 cm. But whether the variation in colour is caused by different food or specific difference, has yet to be ascertained. Colonists in Western Australia aver there are two species. I was disappointed I did not succeed in procuring a skin of the Northern bird. The nest taken at Hamelin, 17th October, was situated in the forked branches of a peppermint tree (*Agonis*). The structure was of tough twigs, firmly lined with grass, and measured 46 cm. over all, with an egg cavity 18 cm. across the mouth, by about 8 cm. deep.

Gymnorhina (sp.?) (Western Crow-shrike).—Believing the Western magpie to be different from either of the Eastern birds (*G. tibicen* and *G. leuconota*), I give a description of its nest and eggs, which however, closely resemble those of its allies. Nest is constructed of sticks and twigs, and lined first with bark, then with a ply about 2½ cm. in thickness of finer bark. Measurements over all about 30 cm., egg cavity 15 cm. across, by about 6½ cm. deep. The eggs, generally three in number, are very beautiful, resembling those of *G. tibicen* taken in Queensland. They are streaked or marbled with rich pinkish brown, upon a bluish or French grey ground. Dimensions—(1) 3·96 x 2·8 cm., (2) 3·86 x 2·76 cm. (3) 4·33 x 2·68 cm. September, October, and Novembe constitute the chief breeding months.

Pachycephala occidentalis, Ramsay (Western Thick-hea —In *Nests and Eggs* (1883), I adopted Gould's descripti but since the Western is found to differ from the Eas variety, and as some doubts exist as to which Gould desc his eggs from, I have deemed it requisite to re-descri' eggs, together with a nest I took at Karridale, 28th C The nest is firmly woven of grass and the soft greei of a certain plant, and lined with fine grass. Dimei about 9 cm. across, with a fairly sized egg cavi' 6½ cm. across the mouth, by 4 cm. deep. T' securely set among the branches and seed pods of The eggs are light yellowish-white, of a darker sl the upper quarter, where are spots of umber and

the latter appearing as if under the surface of th
Texture of shell somewhat fine. Specimens long in
with both ends nearly alike. Clutch two; measuren
(1) 2·48 x 1·6 cm., (2) 2·47 x 1·6 cm.

Sphenostoma cristata, Gould (Crested Wedge-bill).—
received several undoubted examples of the egg of th
from the Gascoyne District, therefore, the habitat of t
may now be extended to Western Australia.

Gerygone culicivora Gould (Western Warbler).—
described accurately the position and structure of thi
nest, but did not succeed in procuring the eggs, wh
warmish-white, spotted especially at the larger en
reddish or pinkish-brown, after the fashion of the
eggs. An egg, from a set of three, measures 1·7 x 1
The nest was taken at Quindalup (Geographé Bay), fr
topmost branches of a peppermint tree (*Agon*
September.

Eöpsaltria georgeana, Q. et Gaim. (White-bellied
—Exceedingly little is known of this rare robin. T
nest that came under my observation was in a
(*Casuarina*) sapling, bordering a creek in close proxi
the Tor Bay Timber Station, owned by Messrs. C.
Millar of this city. The second nest I took was in
forest, artfully hid in the fork of a grass tree (*Xantho*
where the drooping rush-like foliage carefully conce
The nest is built of leaves, fine twigs and strips o
and lined with fine rootlets and grass. The specimen
from the *Casuarina* was decorated outwardly with p
dead bracken fronds. Across, the measurement was
9 cm., egg cavity 5 cm. by 3 cm. in depth. I
instance, the eggs were two, of a beautiful olive-gre
out of each set had a distinct bronzy shade upon th
Dimensions—*a* (1) 2·2 x 1·56 cm., (2) 2·13 x 1·5
b (1) 2·11 x 1·53 cm., (2) 2·06 x 1·55 cm.

It will be noticed that the nest and eggs of the
bellied Robin, most resemble those of the Dusky
(*Amourodryas vittata*) of Tasmania, and are totally
the *Eöpsaltria*; therefore, it may be found necessar
that the nest and eggs have been discovered, to al
generic name of the former bird.

Estrilda oculea, Q. et Gaim. (Red-eared Finch).—
the usual bottle-shaped appearance, with the en
through the neck slightly ascending before dropping i
egg chamber, or body of the nest. The structure is

consisting chiefly of a wiry grass (*Calostrophus*), and lined with brittle material and downy seed vessels. Situation chosen, generally *Melaleuca* trees on the margin of streams or swamps, sometimes *Banksias* or other thick bush. Eggs soft white; complement 4 or 5. Dimensions of two examples—(1) 1·73 x 1·22 cm., (2) 1·78 x 1·22 cm.

Cacatua gymnopis, Sclater (Dampier's Cockatoo).—Eggs whitish, rather pointed towards the smaller end. Texture of shell somewhat granulated. Clutch is four in number.* Mr. Woodward, F.G.S., informed me he had witnessed aboriginals taking these cockatoos from the hollow of flooded gums on the Dalgety Creek, Gascoyne District. Young in down have been seen on the Upper Murchison in April; while Mr. Mackenzie Grant, M.L.C., and others, state that numbers of these birds breed under rocks on Dampier's Archipelago, off Nichol Bay. Although this cockatoo was only described by Sclater in 1871, it is really the oldest known of all the Australian cockatoos. Dampier, in August 1699, when in the vicinity of the Archipelago which now bears his name, recorded there was "a sort of white parrots which flew a great many together," and which undoubtedly refers to the bird now under consideration. Therefore, as a vernacular name for this interesting cockatoo, and as there are many inappropriate local appellations, I have taken the liberty of adopting the name of the celebrated navigator.

Platycercus zonarius, Shaw (Banded Parrakeet).—I was somewhat astonished to fall in with this beautiful parrot in the Champion Bay District. To Miss N. Logue, of Ellendale, I am indebted for an egg, and also to Mr. R. H. Cowan, for his assistance in aiding me to procure a series of skins. The egg which is white, was taken from a hollow eucalypt bordering the Greenough River, and measures 2·84 x 2·35 cm.

Euphema petrophila, Gould (Rock Parrakeet).—Eggs of a fine texture, white, round in form, but some examples inclined to oval. A full clutch of 4 measures (1) 2·45 x 1·9 cm., (2) 2·42 x 1·94 cm., (3) 2·5 x 1·98 cm., (4) 2·45 x 1·9 cm.

I was singularly successful in securing a series of the eggs of this comely little parrakeet on Rottnest Island, where the birds breed (without any nest) under shelving or flat sand, or lime-stones, but invariably selecting rocky islets off the main island, notably Green or Parrakeet Island. It gives me pleasure to state, that Mr. A. H. Courderôt, a

* One Example measures 4 x 2·82 cm.

corresponding member of this Society, was the first to present me with the eggs of this graceful parrakeet, also with a pair of live birds which now adorn my aviary.

Synoicus sordidus, Gould (Sombre Swamp-Quail).—Eggs pyriform, of a dirty yellowish-white, minutely spotted all over with dull green or olive. Markings more assimilate those of the Tasmanian, and are a little bolder than the common swamp quail's (*S. australis*). Shells very thick. Complement of eggs, 8 to 10. Dimensions—(1) 3·04 x 2·46 cm., (2) 3·24 x 2·45 cm., (3) 3·16 x 2·44 cm.

On a visit to Breaksea Island, at the entrance to King George's Sound, I found this quail plentiful, and although late in the season (2nd January), the lighthouse keepers pointed out a nest containing nine eggs, and kindly permitted me to remove three for scientific purposes. The nest was a little hollow, lined with dead grass and sheltered under a tussock of grass amid rushes.

Biziura lobata, Shaw (Musk Duck), invariably lays a pair of eggs on the Eastern portion of Australia and Tasmania, yet, however remarkable and unaccountable it may seem, the complement is three in Western Australia. I heard of several nests with that number, and took one myself in a *Melaleuca* swamp at Karridale.

Sterna dougalli, Mont. (Graceful Tern).—Eggs rather round in form; colour varies from greyish to warm stone colour, boldly marked with spots and blotches of a dark umber, patches of grey also appearing under the surface of the shell. Clutch, two eggs. Dimensions—*a* (1) 3·8 x 2·93 cm., (2) 3·82 x 2·94 cm.; *b* (1) 3·96 x 2·82 cm., (2) 3·93 x 2·82 cm.

Gilbert, the able coadjutor of Gould, did not succeed in procuring eggs, but was informed that these terns breed in November. The following extract from my note-book would make it appear that December was the chief laying month:—"Graceful terns in companies of scores, found nesting on parallel dead coral ridges, Pelsart Island, Houtman's Abrolhos, 23rd December, 1889. Birds uttering usual shrieking cries. Eggs two, but sometimes one, the nest being a hollow made in the rough coral filled with finer coral, shells, &c. Coral, not the usual cream colour or white, but bluish-grey, as if by long exposure to the elements, and sustaining patches of lichen (*Lecidea*). On another ridge adjacent, were a few ternlets (*Sternula nereis*) breeding; also two eggs, sometimes one. Young in down

whitish, with pale-yellow feet and bill. Young in down of graceful tern white underneath, rest of surface slightly mottled; feet and bill pink. Eyes dark in both species."

In conclusion, I should like to record the dates and breeding localities of two petrels.

First.—The Fleshy-footed Petrel (*Puffinus carneipes*, Gould), which I found breeding on Breaksea Island, King George's Sound. The first eggs were noticed by the lighthouse keepers on 30th November, and were plentiful on 7th December. The same dates apply to Mutton-bird Island, Tor Bay, where some eggs were also collected on the mainland. This is the first instance, as far as I am aware, of petrels laying on the mainland of Australia. They invariably resort to isolated rocks or islands for the purpose of breeding. The burrows of the fleshy-footed petrels are mostly tunnelled in sandy soil, in an oblique direction from four to six feet, but sometimes to the depth of eight feet.

Second.—The Wedge-tailed Petrel (*Puffinus sphenurus*, Gould).—I first made the aquaintance of this nocturnal creature on Rottnest Island, where I obtained a couple of eggs on 22nd November. When I reached Rat Island (Houtman's Abrolhos), I ascertained the first eggs there were discovered in the burrows on 17th November, while the majority of eggs were collected the following week.

Some of the islands of the Abrolhos, which are about fifty miles off Champion Bay, for prodigious numbers of birds, brought to my recollection the journey of the Israelites, when quail fell among them. Truly it seemed to me, when upon Rat Island, that the face of the earth, as well as the sea, was covered with birds, "as it were a day's journey on this side, and as it were a day's journey on the other side," round about our camp. For there were noddy terns breeding as close as they could pack upon the bushes, sooty terns were croaking over their task under the bushes, while the ground underneath was honeycombed with petrels, moaning and groaning, especially at night, when it might be readily said, the whole island "groaneth and travaileth in pain."

Mr. G. K. Beddoes, C.E. (Manager of the Guano Station), and I, calculated that there were about 300 acres of Rat Island occupied by birds, and that they averaged at least one bird for every square yard, giving a total of 1,452,000 birds for one small island alone. Some of the photographs, exhibited to-night, will give a very fair idea of the flights and multitude of birds.

Proc R S Victoria Plate 2

Fig 2.

Fig 1.

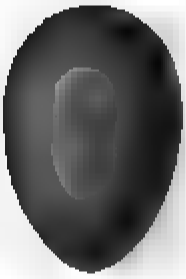


Fig 1


Fig 2.

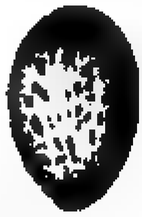
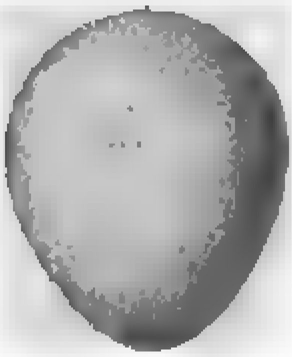


Fig.3


Fig 4


Fig. 5.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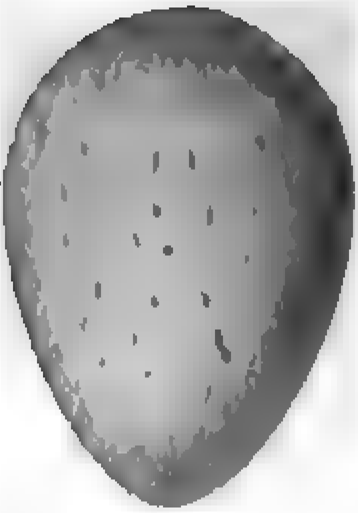
Fig 7

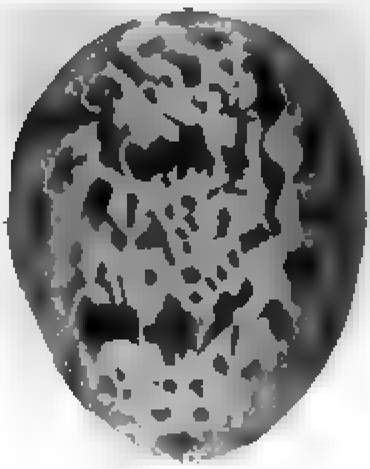
Fig 8

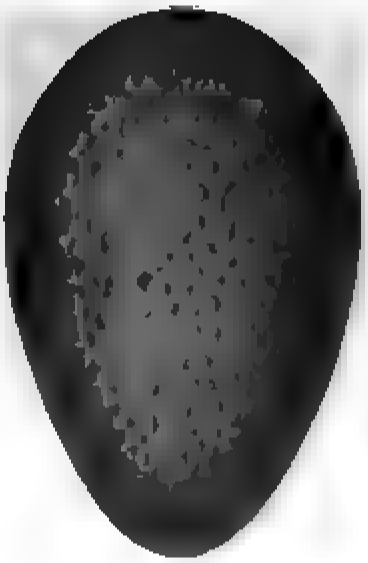
Fig 9

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EXPLANATION OF PLATES.

PLATE I.

FIG. 1.—Egg of Eöpsaltria georgeana.
FIG. 2.—Egg of Sterna dougalli.
FIG. 3.—Egg of Gerygone culicivora.
FIG. 4.—Egg of Pachycephala occidentalis.
FIG. 5.—Egg of Astur cruentus.
FIG. 6.—Egg of Synoicus sordidus.
FIG. 7.—Egg of Strepera plumbea.
FIG. 8.—Egg of Sterna dougalli.
FIG. 9.—Egg of Strepera plumbea.

PLATE II.

FIG. 1.—Nest of Eöpsaltria georgeana, the White-bellied Robin.

FIG. 2.—Nest of Pachycephala occidentalis, the Western Thickhead.

ART. II.—*On the Occurrence of Certain Fish in Victorian Seas, with Descriptions of some New Species.*

(With Plate III.)

By A. H. S. LUCAS, M.A. (Oxon.), B. SC. (Lond.)

[Read May 8, 1890.]

I.—*Fish collected by Mr. J. Bracebridge Wilson, in his Dredging Excursions during the summer of* 1887–8.

(1) *Hippocampus breviceps*, Peters.

This little fish was found in abundance near Port Phillip Heads, by Mr. Wilson. We have also met with it on weed at nearly all our dredging stations in the Bay.

(2) *Hippocampus abdominalis*, Kaup.

Mr. Wilson forwarded one specimen from the Straits.

(3) *Syngnathus phillipi*, nobis.

Obtained by Mr. Wilson at nearly all the outer stations of Port Phillip in large numbers. A description is appended.

(4) *Chilobranchus rufus*, Macleay.

Very abundant at all stations near the Heads. Found also freely at Cheltenham.

(5) *Cristiceps australis*, Cuv. et Val.

Taken by Mr. Wilson at stations near the Heads in great abundance. I consider *C. howittii*, Castelnau, to be a form of *C. australis*.

(6) *Cristiceps wilsoni*, nobis.

Met in company with *C. australis* ; abundant.

(7) *Cristiceps phillipi*, nobis.

With *C. wilsoni* and *C. australis*, but only three specimens forwarded. Descriptions of (6) and (7) are appended, as also outline figures.

(8) Two species of *Gobius*, not yet determined, but probably new.

(9) A single specimen of a fish belonging to the Labridæ. It is probably new, but more material is necessary for a proper description to be given.

II.—*Fishes obtained in the Port Phillip Biological Survey, Dredging, or Short Excursions.*

(1) *Pegasus lancifer*, Kaup. From Sandridge.

(2) *Stigmatophora argus*, var. *brevicau data*, nobis. From Geelong Inner Bay.

(3) *Sticharium dorsale*, Günther. From Laverton Bay; abundant.

(4) *Clinus despicillatus*, Richardson. From Portarlington and Sandridge.

(5) *Callionymus*, sp. From Geelong.

(6) One specimen of *Gobiesox*, sp. From Brighton.

III.—*Fish obtained by Mr. J. Bracebridge Wilson, in the summer of* 1888-9.

In addition to those previously received from Mr. Wilson, were—

(1) *Mordacia mordax*, Gray. One specimen; young.

(2) *Sticharium dorsale*, Macleay.

(3) *Tripterygium macleayanum*, nobis.

A single specimen; description and figure appended.

(4) *Syngnathus semi-fasciatus*, Günther.

A single but large and typical female specimen. The colours exactly correspond with those given by Count Castelnau. P.Z.S. Vict., Vol. I, p 199.

(5) *Hippocampus*, sp.

I have not yet been able to satisfy myself as to the identity or novelty of this handsome specimen.

(6) *Pristiophorus cirratus*, Latham.

A male specimen, 33 inches long.

(7) *Urolophus cruciatus*, Lacep.
Two male specimens, 11 inches and 6 inches long respectively. The younger showing the pattern of the colour markings very clearly.

(8) *Rhina squatina*, L.
A young female, 11 inches long.

(9) *Ostracion auritus*, Gray.
Two specimens, 7 and 7½ inches long respectively.

IV.—*Fish Trawled in Bass' Straits by the Government Steamer, "Lady Loch," in July* 1889. *Depth* 10–39 *fm.*

(1) *Upeneichthys porosus*, Cuv. et Val. (sp.)
One specimen. Between Belfast and Warrnambool, 25–27 fm.

(2) *Monacanthus rudis*, Richardson. One specimen.

(3) *Monacanthus güntheri*, Macleay. One specimen.

(4) *Cyttus australis*, Richardson. Two specimens, both young.

(5) *Trigla polyommata*, Richardson. One young specimen.

(6) *Lepidotrigla vanessa*, Richardson. One specimen.

(7) *Ostracion auritus*, Shaw.
Two specimens, each about 5½ inches long.

(8) *Cristiceps australis*, Cuv. et Val. One specimen.

(9) *Pempheris macrolepis*, Macleay.
A number of these fish were obtained between Portland and Belfast. The sailors called them Galldie. Only one specimen was forwarded. They do not often come to market. I have never seen one there.

Cristiceps wilsoni, n. sp.

D. 3/27·28/3. A. 2/21. V. 3. About two inches long.

Body compressed ; height, one-fourth to one-fifth of total length. First dorsal inserted over operculum, rather longer than earlier rays of second dorsal. Ventrals not quite reaching to vent ; caudal rounded ; principal caudal rays, 11.

Second dorsal attached by membrane to base of caudal; anal free from caudal. Clear membrane between the first and the last two of the soft dorsal rays. Scales small, distinct. Lateral line continuous, with the curve usual in the genus.

Profile of head and snout convex; lower jaw slightly protruding; diameter of eye greater than length of snout. Supra-orbital tentacles red, simple, nearly as long as diameter of eye; snout tentacles pale, small, jointed.

Colour variable, as probably in all the species of the genus. Body colour reddish, with a number of vertical dark red-brown to rose-coloured bands, which may or may not be continued over the vertical fins. The first band incomplete below the first dorsal, two others on the trunk, and four on the tail. Colour-markings of head inconstant.

Dredged at several stations near Port Phillip Heads, by J. Bracebridge Wilson, to whom I have great pleasure in dedicating the species.

In a single specimen are found the following characters which I record, but do not wish to establish a new species. The present state of our knowledge of the species of this genus is eminently unsatisfactory, and the limits of variation have scarcely been considered :—

D. 3/24/3. A. 2/17. V. 3.

Body compressed; height $4\frac{1}{3}$ in total length. Length 58 mm.

First dorsal situated above operculum; rays equal, not exceeding those of second dorsal. Ventrals reach about half-way to vent. Second dorsal united to base of caudal; anal free; scales minute and distinct. Supra-orbital tentacles simple, red; snout tenacles short, pale. Colour reddish, with vertical rows of interrupted black and yellow blotches. Vertical fins, with corresponding red bands; short white band from orbit across præoperculum.

This specimen is figured in Plate III, Fig. 1.

Cristiceps phillipi, n. sp. Three specimens.

(a) D. 3/30/2. A. 2/23. V. 2.

Snout rather pointed. First dorsal over operculum; second ray longest; third shortest; clear membrane between the two soft rays. Scales distinct; lateral line distinct anteriorly. Height about four times in total length. Pectorals nearly to vent; ventral rays long, slender; anal free from caudal. Supra-orbital and snout tentacles very short and small. Colours ill-defined in spirit specimen.

Length 67 mm. Dredged Port Phillip Heads, by J. B. Wilson, 1888–9.

This specimen is figured in Plate III, Fig. 2.

(*b*) D. 3/30/3. A. 2/23. V. 2.

First dorsal over operculum ; first and second rays much longer than third ; clear membrane between the soft rays. Scales distinct. Pectorals to vent ; ventral rays long, slender. Height nearly five times in total length. Supra-orbital tentacles aborted, and snout tentacles short, but distinct. Colour, few vertical dark bands ; white band from eye across præoperculum and operculum, continued along trunk and tail, below the lateral line to the root of the caudal. Length 53 mm. Dredged at Port Phillip Heads by J. B. Wilson, 1888–9.

Tripterygium macleayanum, n. sp.

D. 3/14/12. A. 22. L. lat. 25. L. tr. 3/1/8. P. 15. V. 2.

Height of body rather less than length of head, and about equal to length of tail-fin. Length of head constituting about two-sevenths of combined length of head and trunk, without caudal fin. Insertion of ventrals half-way between tip of snout and vent. Pectorals reaching nearly opposite to end of second dorsal. Scales with fine toothed edges. Lateral line distinct to opposite the fourth ray of the third dorsal. Eyes large, diameter about one-third length of head. Short fringed tentacles above orbit and at outer side of nostril. Inter-orbital space concave, narrower than diameter of eye. Line of fringed papillæ above and behind orbit. Rows of finely-toothed scales on sides of occiput, upper edge of operculum, and front of præoperculum. Colour (spirit) orange, with broad, indistinct, red vertical bands ; eyes red ; vertical fins pale, with black margins. Length of single specimen, 50 mm. It is figured in Plate III, Fig. 4.

Dredged by J. B. Wilson near Port Phillip Heads, summer of 1888–9. Dedicated to the Hon. Sir William Macleay, author of "The Ichthyology of Australia."

Syngnathus phillipi, n. sp.

D. 25–26. Osseous rings 18 + 40–44, reckoning the complete ring which bears the pectoral fins as the first body ring.

Adults between four and five inches long. Length of snout, about half that of head. Length of trunk, about

twice that of head. Length of tail $1\frac{1}{2}$ to $1\frac{7}{8}$ that of head and trunk together.

The actual measurements of four specimens are—

	Head.—Snout.	Trunk.	Tail—Tail-fin.	Total Length.
a ♀	$\underbrace{7{\cdot}5 \quad 7{\cdot}5}_{15}$	28	$\underbrace{75 \quad 3}_{78}$	121 mm.
b ♂	$\underbrace{5 \quad 6{\cdot}5}_{11{\cdot}5}$	22·5	$\underbrace{62{\cdot}5 \quad 2{\cdot}5}_{65}$	99 mm.
c ♂	$\underbrace{5{\cdot}5 \quad 6}_{11{\cdot}5}$	28	$\underbrace{65 \quad 2{\cdot}5}_{67{\cdot}5}$	107 mm.
d ♀	$\underbrace{6{\cdot}5 \quad 6{\cdot}5}_{13}$	27·5	$\underbrace{59{\cdot}5 \quad 2{\cdot}5}_{62}$	102·5 mm.

Depth of trunk in males, one-fifth; in females, one-fourth of its length. Dorsal fin occupies about two body and six tail-rings; the egg pouch in the males extends over the first 15 to 18 tail-rings. Ridges very distinct on snout, rest of head, trunk, and tail.

A median dorsal on the snout, forking, opposite the middle of the eyes, into two low branches which join the supra-orbital behind the eyes. Supra-orbital prominent, converging in front of eyes to just reach the dorsal median of the snout, and continuing behind, as the upper lateral ridges of the head. Inter-orbital space concave; median ridge on crown of head extending, once interrupted, to terminate opposite the insertion of the pectoral fins. Nuchal lateral ridges continuous, with upper lateral edges of trunk; dorsal surface of neck much narrower than that of head or trunk; horizontal ridge across operculum; lateral ridges from tip of snout, diverging to the eye on either side. In the males there is a marked tetrahedral prominence on the ventral surface of the head, just behind the level of the eyes, formed at the point of union of the median ventral ridge of the snout, a transverse ridge along the origin of operculum on either side, and the median ventral ridge of the head, continuous with that of the trunk behind. This projection is quite wanting in the females.

Sides and back brown, with narrow, whitish, vertical bands near the front border of several of the lateral plates; under surface lighter. Keel of ventral ridge of *trunk*, black. Males darker. In some of the males, white spots instead of bands: in some of females, rows of black spots across operculum and on under surface of snout. Upper

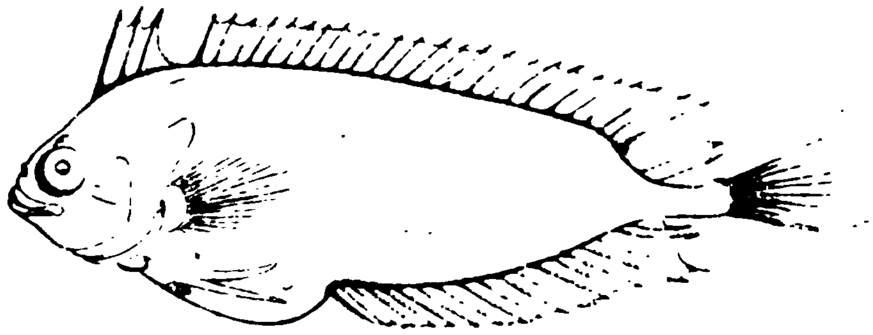


Fig. 1.

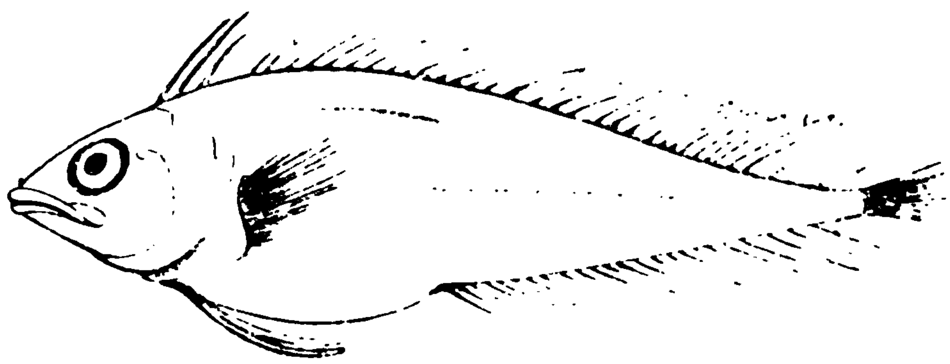


Fig 2.

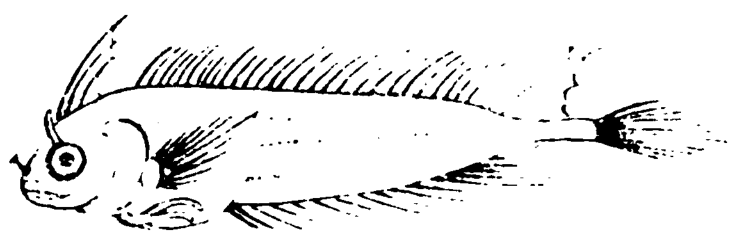


Fig 3.

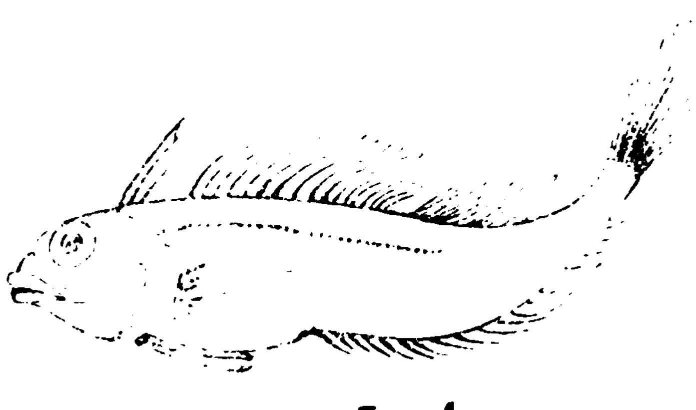


Fig 4.

surface of head, operculum, and snout, with irregularly white lines, bands, or patches, more or less conforming to the ridges.

Dredged at Port Phillip Heads by J. Bracebridge Wilson. Named from the locality.

Stigmatophora argus, Rich., var. *brevicau data.*

D. 49 or 50. Osseous rings 20 + about 60.

Snout 17 mm. }
Skull 8 mm. } Head 25 mm. Trunk 46 mm. Tail 87 mm.

Dorsal spots black, without white edges. Green.

Differs from *S. argus* in relative length of tail, and in the absence of the white rings round the black spots. Spots arranged in six tolerably regular longitudinal series.

Dredged in seaweed, Geelong Inner, December 10, 1887.

Macleay's account of *S. argus*, Rich. T.Z.S. III, p. 183, Pl. 7, Fig. 2. Günther, Cat. VIII, p. 189.

D. 49–52. Osseous rings 20 + about 75.

Snout very long, about twice as long as the remaining part of the head. Operculum with a slight ridge in young examples, nearly entirely disappearing in old. Vent below the middle of the dorsal fin. Tail more than twice as long as the trunk; egg pouch shorter than the trunk. Upper parts with numerous small, black, white-edged ocelli, sometimes irregularly arranged, sometimes forming longitudinal or transverse series. Tasmania. Port Jackson.

EXPLANATION OF PLATE.

Outline figures of some new Victorian Blennies. All the figures are life size.

Fig. 1.—*Cristiceps wilsoni*, n. sp. The variety noted is the one figured, but the general outline is that of the species.

Fig. 2.—*Cristiceps phillipi*, n. sp.

Fig. 3.—*Cristiceps australis*, Cuv. et Val. A young specimen, drawn for purposes of comparison.

Fig. 4.—*Tripterygium macleayanum*, n. sp.

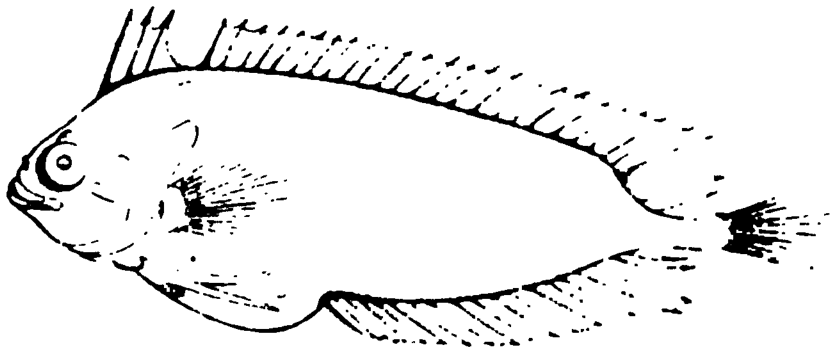


Fig. 1.

Fig 2.

Fig 3.

Fig 4.

A H.S. Lucas. del

ART. III.—*Anthropology in Australia.**

By A. W. HOWITT, F.G.S.

[Read Tuesday, May 13, 1890.]

For the first time in Australia the study of Anthropology has taken up a definite position, by the formation of Section E of the Royal Society of Victoria. It seems remarkable that the science of man should have been the last to have attracted special attention here, where there are unrivalled opportunities for its presentation in a country where man still exists in as nearly a primitive condition as it is possible to find in any part of the world.

It is certainly true, that since the time when the white man took up his abode in Australia, there have always been more or less numerous enquiries into native customs, commencing with Collins, who compiled his work called "An Account of New South Wales" in the early years of settlement. Since then, until now, there has been a constant succession of observers who, as explorers, settlers, and missionaries, have devoted more or less time and attention to enquiring into and recording the customs and the beliefs of the Aborigines who wandered over the Australian land. These works, and numerous detached accounts which are scattered through, and I may say buried in, the transactions of societies here and elsewhere, form a literature of considerable extent, and of very varied degrees of authority and value. In the great majority of these works, even in some of the most recent, which profess to be written with authority, it is dangerous for any one to accept the statements made without such knowledge on the part of the reader as will enable him to form an independent opinion.

The time has now come for this great mass of material to be digested, and for those portions which are of value to be extracted, circulated, and placed in such form that it may be possible to make some generalisation. I have long proposed to myself to attempt this in connection with a work on the

* An Introductory Address, read before Section E.

organisation and the customs and beliefs of Australian tribes, for which I have been engaged in collecting material for many years, both personally and through correspondents in the greater parts of Australia. These materials remain still in a great measure unused, but I am at present unable to form any opinion as to when the time may come in which the pressure of official duties will permit of my devoting the necessary leisure, not only to the condensation and arrangement of my own data, but also to the condition of the great mass of material in other works to which I have referred.

In this address I do not propose to enter upon any general review of the science of Anthropology in its Australian aspect, but to confine myself to tracing out briefly the progress and present position of that part to which my own special attention has been devoted—namely, the probable origin and development of social institutions. In this study, the origin and development of the family forms an essential element.

In investigations such as these, the white man who has been born and bred and trained in the ways of civilisation is at a disadvantage, unless he has had such intimate intercourse with savages as to enable him to place himself more or less in their mental standpoints, to see as they see, and to reason as they reason. Few white men have been in that position, and yet fewer of those have been competent to avail themselves of their opportunities.

Buckley and Morell, who will serve for examples, lived for years with Australian tribes, and they show how white men under such circumstances may not only descend nearly to the level of the savage, but after again rejoining their own people, are unable to give even as clear an account of the Aboriginal society, of which they formed a part, as an average blackfellow. So far as one can ascertain, they appear to have been quite ignorant of even the rules which govern the intermarrying classes of the community. Even educated men, with more or less scientific training, do not, as it would seem, always see matters which must have been directly within their view. I was struck by this when reading a late and interesting work by the naturalist Lumholz, on the "Aborigines of the Herbert River in Eastern Queensland." I observed that even he, after some four years of more or less intimate acquaintance with those people, does not seem to have seen much below the surface. He makes no mention of the laws governing their society, as regards marriage, nor does he seem to have seen or to have had des-

cribed to him the secret ceremonies of initiation to manhood, which must certainly exist, and which are most important as furnishing a key to many otherwise puzzling customs.

This, then, being generally the case with those who have personally observed these savages, what can be expected from those who have taken up the observations of others for the purpose of generalisation as to the origin of social institutions in the Australian tribes, or generally throughout the world. This becomes clearly evident when one considers the conclusions reached as to the origin of the family by Bachofen, McLennan, Mayne, and Morgan, who may be here taken as representing four well marked and progressive stages of opinion.

Bachofen, working altogether from a classical standpoint, elaborated a strange and somewhat grotesque hypothesis of a former universal gynecocracy. He held that of old mankind was found in a condition of universal hetarism, from which it was raised by the establishment of gynecocracy by women, as a continuous protest against the degradation to which man's superior physical powers had reduced her. It is evident that he saw, dull and distorted, as through a glass darkly, the traces of the Matriarchal system which was once universal, and which still exists among certain savage tribes.

McLennan, advancing a step further, built his theory on a wider foundation of classically extinct and modern existing custom, and saw, as he believed, the origin of the family in polyandry, which was brought about by a scarcity of women, produced by female infanticide. The actual existence of polyandry as a form of the family, the numbers of facts marshalled by him with consummate ability, both from ancient and modern sources, caused his theory to be widely accepted, and to have an authority which is still recognised by a section of anthropologists.

Mayne was led to form certain views by his investigation into the true character of early institutions as handed down to us by the archaic records of our own Aryan ancestors, illustrated by the existing customs of some of their descendants. He compared his results with the ancient records of Semitic peoples, and he arrived at the conclusion that the primitive form of the family was that known as the Patriarchal, in which the power of the father was predominant, and which was characterised more or less by polygamy.

Morgan had his attention drawn to these questions by his personal observations of the organisation of the Iroquois tribe, of which he was an adopted member. Following out the clue hereby gained, he spread his inquiries over the greater part of the world, and his final results were recorded in his work on "Ancient Society." His views combine, in a great measure, the essential portions of the other hypotheses, and comprise a primitive community with promiscuity, the prevalence of a communal family, within which descent was connected through the mother, and a gradual development therefrom of social institutions through polygamy to monogamy, as we now see it in civilized peoples.

Nearly twenty years back our valued fellow member, the Rev. Lorimer Fison, took up in Australia the work commenced elsewhere by Dr. Morgan, and it was my privilege to join him somewhat later.

In Australia, if anywhere, one might expect to find primitive institutions preserved. The aborigines are in a low ethnic stage. They have been preserved until the settlement of their country by the white man through unknown periods almost wholly from contact with other races in a different stage of culture. Therefore, one might seek with good chances of success among them for, at the least, traces of the earlier form of the family and of society. One might further anticipate that evidence should be obtainable to show either a process of development of or degradation of the social status.

During the last fifteen years, Mr. Fison and myself have been diligently pursuing this line of inquiry against no ordinary difficulties, and with the result that our general conclusions have been received by leading anthropologists with favour. The results of our investigations, so far as regards the questions to which I have now directed attention, are as follows:—

(1) The social organisation of all the Australian tribes is based on the same general principles, with local and individual variations.

(2) The most primitive form of the family is a communal one, as evidenced by the existence in Central Australian tribes of that which we have called the Pirauru practice, under which a number of men, own or tribal brothers, cohabit in common with a number of women who are own or tribal sisters.

(3) Co-existent with the Pirauru practice in these tribes, there is also individual marriage, based upon infant betrothal, or exchange of women. In other tribes individual marriage predominates, with merely traces of group marriage.

(4) Society is organised upon the division of the community into two exogamous intermarrying groups.

(5) This division into two intermarrying groups, each of which is represented in a somewhat modified form by the Pirauru groups, brings into view a set of relationships which are those of group to group, and not those of individual to individual. But the individual takes the relationship of his group.

(6) The relationship terms in use are fundamentally such as would be required by such communal groups, but differ in different tribes in their departure from the primitive type. This departure is in the direction of a differentiation from general into special individual terms.

The general results of these enquiries are, that the earliest social organisation of the ancestors of the Australian aborigines was probably that of an undivided commune, or in other words, of the condition of promiscuity which has been postulated by some authors; the succeeding state was that of a divided commune, with promiscuity limited to each commune, and this still exists here. The Pirauru practice affords, in fact, an explanation of the existing system of polyandry in Thibet, and among the Nairs, on which Mr. M'Lennan's theory of the early state of society rests. He was, therefore, so far correct in assuming polyandry to have been an early social stage, but it was not as we now see, merely polyandry, but polyandry combined with polygyny—in other words regulated promiscuity, such as is now found existing in many of the Australian tribes.

The results thus attained have been reached by a series of stages, in each of which a certain advance was made upon previous hypotheses. This is indeed just that which one may observe in any of the sciences. Step by step data are accumulated as the horizon widens, and each advance establishes some part of the previous hypotheses, while it sweeps away those portions which have been based upon insufficient data.

Our present knowledge of the organisation of Australian tribes stands as I have sketched it. That this knowledge is still incomplete in many important details I readily admit,

but I must maintain that the general features have been sketched out in broad and sufficiently accurate lines, which will not be materially altered by further investigations. Details will be filled in and variations from the typical structure will be observed and recorded. It may be that some even more archaic form of aboriginal society will be discovered in tribes isolated in the desert parts of the western half of the continent. But I am satisfied it will be found that all information will fall into an orderly sequence of development from an undivided commune, with maternal descent, to a community in which individual marriage is completely established, together with a change of descent to the male life.

Such being the case, I may observe further, that in the varied series of social communities existing in Australian tribes, we may safely mark the gradual development of early society, which through savagery had led up, through the status of barbarism, to the present position of civilized man.

The work which still remains to be done in Australian Anthropology is immense, and includes investigations as to the racial affinities of our aborigines, including peculiarities or divergences of physical structure. Also whether, excluding the influence of other races on the northern coasts, there are or are not traces of the fusion in Australian tribes of two or more primitive races. It has long seemed to me possible that the aborigines of Tasmania may have represented the autochthonous inhabitants of the Australian continent, who had thus escaped by isolation from annihilation or absorption —annihilation by being killed by a superior and better armed people, and absorption of women as war captives. I am aware that a similar suggestion has been made by one of our most enlightened and efficient investigators, the Rev. W. Mathews.

Questions also as to the origin of the Australian aborigines also suggest the possibility of the occasional arrival in the northern, north-western, or north-eastern coasts of small numbers of persons of other races by stress of weather. The occurrence of paintings of a remarkable character in caves in Western Australia have been long a subject of discussion, but it seems now that the true explanation of their origin may be that given by Mr. Mathews at the late meeting of the Australasian Association for the Advancement of Science, and that the Australian aborigines are not to be held as being their authors.

The study of the Australian languages also requires immediate attention, not merely by the compilation of vocabularies or the partial study of some language by constructing a grammar. What is required, is the systematic study of one or more languages, by some thoroughly competent philologist, who not only possesses the necessary scientific qualifications, but who also has a thorough colloquial acquaintance with the language. Such a combination it will be most difficult to meet with, but no difficulties should be deterrent where such important results in a linguistic sense are to be obtained. The comparative study of the Australian languages, or rather dialects, for they are all certainly of one stock, should certainly throw some light upon the development of languages, although even, with so primitive a people as the Australian aborigines, we must be immeasurably distant from any indications of the origin of language itself.

There is still also a great field for enquiry into the folk lore of the tribes. I have found that the tales and fables told by the old people, in some cases clearly throw a light upon the past history of the tribe, or upon some part or other of its organisation which has died out.

The Deluge legends of the tribes of the south-east coast, point to the occurrence during their occupancy, of some of the oscillations of level, the results of which are patent to the geological observer.

It may even be, that the study of the folk lore may illumine the most obscure but most interesting subject—the origin of totems.

Numerous other subjects await further enquiry. For instance, the alleged or assumed powers of the native wizards or doctors, the knowledge of, and the practice by them of hypnotism, the secret ceremonies of initiation, the use of the gesture language, the knowledge of medical herbs and other remedies and practice of simple surgery, are all subjects which will bear further and exhaustive enquiry. A study of the songs of these aborigines would also prove a valuable contribution to the science of music, for comparison with the musical efforts of other early peoples. A study of the various implements and weapons used by Australian tribes would, I am confident, lead to interesting results bearing upon the development of appliances useful to man. For the Australian aborigines differ much among themselves in the perfection to which they have brought their imple-

ments, weapons, or the methods employed for catching game. I may point to the comparatively rude spears in some tribes, as contrasted with the highly-finished chalcedony spear points from North-western Australia.

I may here note in this connection, that materials for an exhaustive work on Australian stone implements, are being collected by Mr. R. Etheridge, jun., of Sydney.

In all the enquiries to which I have referred, the members of this section can aid either personally, where it is still possible to make enquiries from the aborigines, or by interesting persons living in other parts of Australia, where the aborigines are still numerous. Much most valuable information has been lost for ever, through the extinction of native tribes. The aborigines in all parts of Australia where settlement is in progress, are more or less rapidly dying out, and even where this is least apparent, the contact of the white man destroys the primitive structure of their society, and modifies their beliefs. Indeed, in all parts of Australia the native race is doomed to destruction sooner or later; contact with the white race is fatal; the aborigines lose the original savage virtue, and acquire instead our vices which destroy them.

It behoves us, therefore, as representing Anthropological science in Australia, to set earnestly to work to record all that can yet be learned as to the customs and beliefs, the arts of peace and war, of probably the most primitive race now existing of mankind.

Art. IV.—*The Nomenclature of Chicken Embryos for Teaching Purposes.*

(With Plates 4, 5, 6 and 7.)

By Professor W. Baldwin Spencer, M.A.

[Read Thursday, May 8, 1890.]

The method of indicating stages in chicken embryos by the number of hours or days during which the egg has undergone incubation is unsatisfactory, inasmuch as different eggs incubated for the same length of time will be found frequently to contain embryos which have reached by no means similar stages of development.

A more satisfactory method is to give to the successive stages certain fixed and simple designations. This plan was adopted by Balfour in the nomenclature of elasmobranch embryos; and, for teaching purposes, the same system may be adopted with advantage in the case of chicken embryos.

The following indicates, briefly, a series which I have found convenient, and which is being adopted in connection with a students' manual now in course of publication. The stages are based upon the external form, and in this way the embryos may, as in the case of elasmobranch embryos, be classified without recourse to section-cutting, or the examination of the internal anatomy.

Each stage is indicated simply by a letter of the alphabet, and to avoid confusion, the letters *I* and *J* have been omitted.

Stage A.—This includes the early stages, commencing with the appearance of the first segmentation furrow in the germinal disc, and terminating in the formation of the blastoderm. This stage may be said to be passed through by the egg during its descent down the oviduct, and before incubation takes place.

Stage B.—The pellucid and opaque areas become defined, and in the hinder portion of the former, the "embryonic shield" is formed.

Stage C.—The primitive streak and primitive groove are formed, and at the close of the stage, the notochord can be seen passing forwards from the anterior end of the primitive streak.

Stage D.—The neural folds appear; they are widely separate posteriorly, and between them, below the middle of the neural groove, the notochord is clearly seen.

Stage E.—The first pair of mesoblastic somites appear.

Stage F.—Four pairs of mesoblastic somites are present.

Stage G.—Eight pairs of mesoblastic somites are present.

Stage H.—Fourteen pairs of mesoblastic somites are present. This is the last stage in which the long axis of the body of the embryo lies in a straight line.

Stage K.—Eighteen to twenty pairs of mesoblastic somites are present. The body of the embryo is just commencing to be curved at the anterior end. The auditory pits are widely open.

Stage L.—The first gill-cleft appears. Some twenty-four pairs of mesoblastic somites are present. The auditory pit is widely open. The heart lies to the side of the body, and has the form of a tube curved into an S shape. The amnion has grown backwards over the head, nearly to the level of the gill-cleft and the heart.

Stage M.—Three gill-clefts are present. The outline of the body becomes more clearly marked at the posterior end. The amnion encloses the whole head and neck region. The eye is prominent, and the choroid fissure large and well marked.

Stage N.—Four gill-clefts present. The amnion commences to grow forward from the posterior end, and the Wolffian ridge appears on either side.

Stage O.—Four gill-clefts present. The amnion almost completely encloses the body. The limbs appear as broad processes of the Wolffian ridge. On the ventral surface, the allantoïs appears as a somewhat hemispherical protuberance at the posterior end, and the tail is formed as a blunt curved process. The alimentary canal is nearly closed in.

Stage P.—The embryo lies completely on its left side, and is completely enclosed by the amnion. The allantoïs forms a prominent sac-like structure. The anterior and posterior limbs are prominent blunt protuberances. The

two olfactory pits are widely open, and a groove from each leads down to the mouth. The fronto-nasal process is not yet well marked.

Stage Q.—The gill-clefts are disappearing. The mid brain forms the most anterior and prominent part of the head. The limbs form prominent blunt processes, of which the anterior are the longer. There is no appearance of digits. The heart is enclosed within the body wall. The eye is deeply pigmented, and the choroid fissure prominent. The allantoïs stretches round to the dorsal surface. The body is curved, so that the posterior limbs almost touch the head in the region of the cerebral hemispheres. The fronto-nasal process is broad, and the olfactory pits widely open.

Stage R.—The gill-clefts have disappeared. The cerebral hemispheres have grown, and the mid brain is less prominent than in the previous stage. The eye is prominent, and the choroid fissure is not very distinct. The fronto-nasal process begins to be prominent when seen from the side. The anterior limb is curved, so that the proximal and distal halves form a sharp angle with each other, the elbow being thus indicated; the extremity of each limb is flattened out, but there is no clear indication of digits. The tail is clearly marked. The olfactory pits are slit-like, and the mouth much smaller than in the preceding stage.

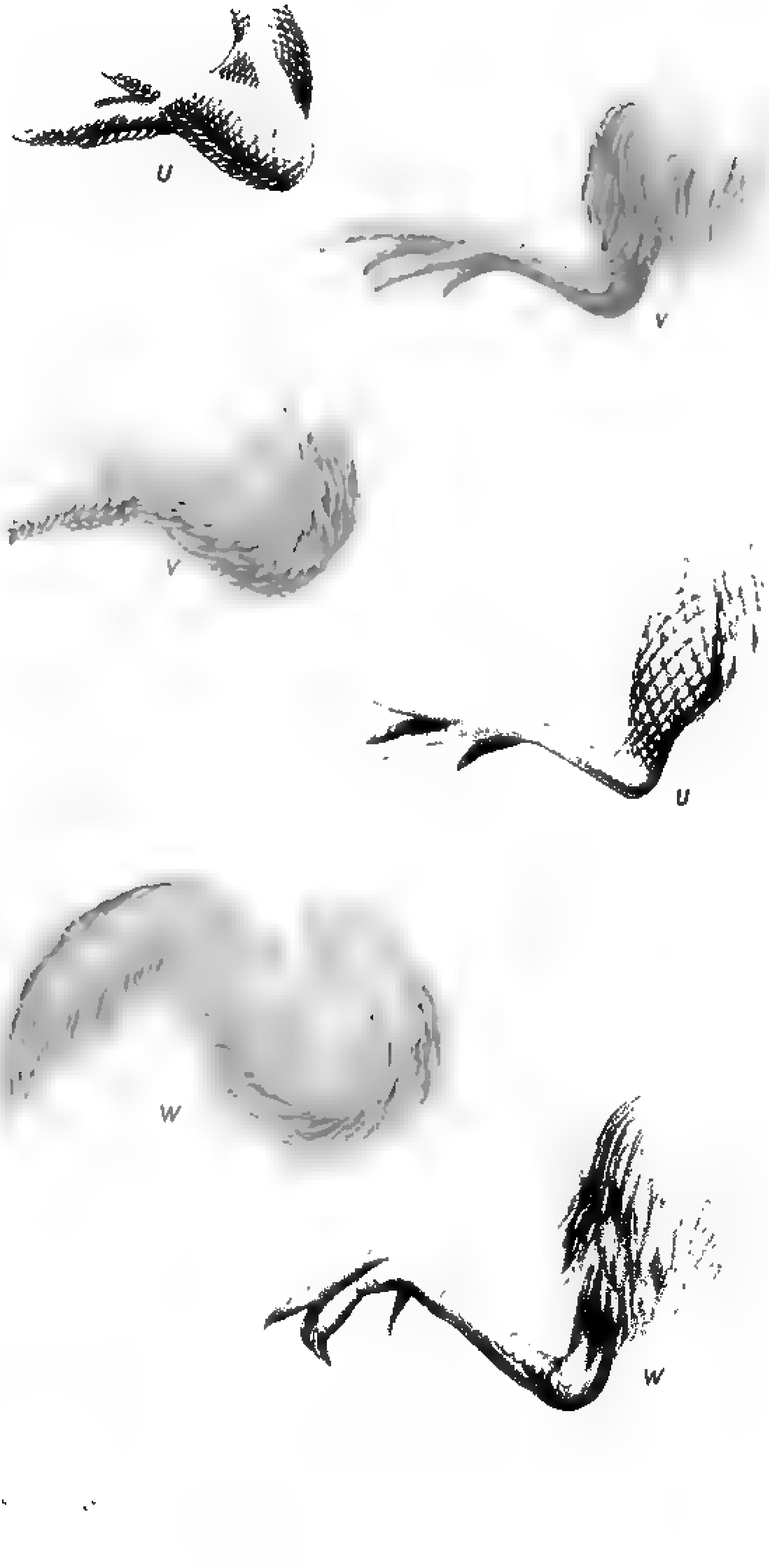
Stage S.—The head has increased in size very markedly, relatively, to the rest of the body. The eye is very large, and the nictitating membrane appears as a fold. The fronto-nasal processes begins to be drawn out into a beak-like structure, and has almost, if not quite, united on either side with the maxillary process, leaving only the two external nares leading into the olfactory pits. The hind limb shows a well-marked bend, and is longer than the anterior. The anterior limb shows two blunt processes at its extremity, a larger and a smaller, and the posterior limb shows traces of four digits.

Stage T.—The rudiments of feathers appear in the form of a series of rows of knob-like processes on the head, back, ventral surface, tail, and the proximal part of the limbs. The beak is well marked, and has a small whitish knob on its upper surface. The anterior limb shows very clearly, at its extremity, a smaller and a larger process, the latter being divided into two digits. Four digits are very distinct in the posterior limb.

Stage U.—In the anterior limb the smaller process, indicating the first digit, is still very distinct. A special series of processes indicating feathers are developed along the post-axial border, and the third digit begins to become indistinguishable. The arm lies parallel to the long axis of the body, the forearm is bent forward at a sharp angle to this, and the manus projects at right angles to the long axis of the body. In the hind limb, the proximal part is covered with long processes indicating feathers, the middle portion with blunt processes, and the distal portion is developed into a definite foot.

Stage V.—The first digit loses its prominence, and the third one has almost disappeared. The whole is covered with developing feathers. In the hind limb, the middle as well as proximal portion is covered with hair-like processes, still longer than in the preceding stage.

Stage W.—In the anterior limb the first digit can only just be distinguished, and the limb has assumed a wing-like form. In the hind limb the divisions are bent at sharp angles upon one another, and the four digits have assumed very much the adult condition.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Art. V.—*Observations on the Movements of the Heart of the Copper-head Snake (Hoplocephalus superbus, Günth.) in and out of the Body.*

By D. McAlpine, F.C.S.

[Read June 12, 1890.]

Having already carried out a series of observations on the movements, both of progression and pulsation, in the hearts of a few specimens from each of the five great divisions of the Vertebrata, and which were communicated to the Royal Society of Edinburgh last year, I thought it might also be of interest to members of this Society, to have the results in the same direction from a few more well-known native animals.

The two specimens of copper-head snake, which supply the material for the first portion of this paper, were captured at Oakleigh, on 21st April. The larger of the two was killed on the spot, by severing the spinal cord at its junction with the brain, and the other was taken home alive to be chloroformed. Since it is part of this investigation to see the effect of different modes of death, on the after-movements of the heart, I will describe separately and briefly these two cases. The heart is situated between $\frac{1}{8}$ and $\frac{1}{7}$ of the length of the body from the head end, and consists of two auricles and a ventricle, the single cavity of which is imperfectly divided by a septum. The first snake killed on the spot in the manner indicated was $30\frac{1}{2}$ inches long when fully extended, and as Professor McCoy in his "Prodromus" gives the average as 5 ft or 6 ft. for this species, this one would be regarded as rather a small specimen. It was a male, like the other, and killed at 2.30 p.m. About $5\frac{1}{2}$ hours afterwards, it was opened up from the ventral surface, and the heart was found beating steadily at an average rate of $9\frac{1}{3}$ beats per minute, or 93 beats in 10 minutes. The heart was still within the pericardium, which was next removed, and the beats again observed. An average of 8 beats per minute

was now recorded, or 81 in 10 minutes, ranging from as low as 5 beats per minute, when there were relatively long pauses, up to 11 in a minute. The movement was less regular without, than with the pericardium, and this is in keeping with what we know of the steadying action of the pericardium and its contained fluid.

The heart was next excised about 6 hours after death (exactly at 8.39 p.m., or 34 minutes after the body was opened up). The auricles alone contracted for the first minute, then the ventricle began, but at a much slower rate than the auricles. Hence the ventricle and auricles did not contract in unison, but independently. The ventricle contracted at first at an average rate of 4½ times per minute, or 22 times in 5 minutes, while the auricles in the succeeding 5 minutes contracted 92 times, or on an average of 18½ times per minute. During the same period, the ventricle only contracted 18 times, or about one-fifth as often. The ventricle gradually began to beat at distant intervals, sometimes even of ten minutes, and finally ended with three beats at intervals of 1, 1, and ½ minutes respectively. The ventricular contraction entirely ceased 23½ minutes after excision. Meanwhile, the two auricles continued to beat as near as may be together, but the left auricle ceased about the same time as the ventricle. The right auricle still continued beating steadily at a rate of 8 beats per minute, then it gradually became enfeebled, and ceased to beat about 35 minutes after the left auricle.

Thus the ventricle and left auricle beat for about 6½ hours after somatic death, and the right auricle for about 7 hours, and almost exactly one hour after excision of the heart. For purposes of comparison, however, we will reckon the excised heart as a whole, and the pulsations would then cease with the ventricle, or 23½ minutes after excision. Both ventricle and auricles reacted to stimulation, such as the prick of a pin after spontaneous beating had ceased. The ventricle was found to do so for over 45 minutes, and the right auricle for about 15 minutes. The temperature of the room was pretty constant throughout at 19° C., and the heart was simply laid out on a moistened plate.

The second and much smaller snake, measuring only 16 inches, was killed with chloroform. The effect of the chloroform was, that the snake coiled itself up and remained perfectly motionless, all but the tip of the tail. This moved to and fro for about 10 minutes, then quivered only,

and finally the snake was removed from the vessel with its mouth now gaping. The heart was first observed with the pericardium intact, and had an average of 39 beats per minute for the first 3 minutes. The pericardium was next slit up, and the heart exposed, and the average for 3 minutes was 23 beats per minute. The heart was now excised, 14 minutes after the removal of the snake from the chloroform. At first it beat very slowly, only about 8 per minute, then it increased after 20 minutes to an average of 31 beats per minute, and at the end of an hour it was beating at the average rate of 33 per minute. Throughout this period the beating was regular, that of the ventricle and two auricles alternating in regular succession.

When observed two hours after excision, the rate of beat of ventricle and auricles was very disproportionate. While the auricles beat in unison at an average rate of 27 per minute, the ventricle only averaged 9 beats per minute, or one-third that of auricles. Three hours after excision, the auricles averaged 22 beats per minute, and the ventricles only 6, or for 3 minutes in succession, 5, 6, and 7 beats respectively. Shortly afterwards the ventricle ceased to beat, a little over 3 hours after excision. In this instance there was no response to stimulation, at least 30 minutes after cessation of spontaneous beating.

The times of the principal events may now be given. Chloroform was administered at 11.27 a.m., snake taken out at 11.42 a.m., heart excised at 11.56 a.m., ventricle was seen beating feebly but fairly regular at 3 o'clock, p.m.; observed 20 minutes afterwards, and there was no sign of beating, even after watching for some time, so that the excised heart in this instance beat for at least 3 hours 4 minutes. Both auricles continued beating in unison, and 4 hours after excision the average number of beats per minute was 28, the left, however, feeble as compared with the right auricle. Five hours after excision, the average in both was 24 per minute; and 6 hours after excision, the average was 18 per minute, that of the left being now exceedingly feeble. Business here called me away, so that the final beating was not observed, but probably the left auricle ceased first, as in the preceding case. The temperature here varied from 18° to 23° C., slowly and steadily increasing from the former to the latter towards the end of the observation.

A third copper-head snake was obtained on the 14th May at Oakleigh. It was a very young one, only measuring

$9\frac{3}{4}$ inches in length, and was killed with chloroform. Unlike the last, the mouth did not gape after death, but the sensitive tip of the tail trembled occasionally until the chloroform had taken fatal effect. This specimen was only removed from the influence of the chloroform after 34 minutes, and 4 minutes afterwards the heart was exposed. For about a minute no sign of movement was observed, then the beating commenced, and for 4 successive minutes the beats were 37, 46, 47, and 46 respectively. The pericardium was next removed as delicately as possible, and the beats fell to less than half the above, although only two minutes elapsed between the two records. The beating, however, was very regular, and for 3 successive minutes gave 21 per minute. The heart was now excised, and the beating at first was rather irregular. Two minutes after the last record the beats were 20 per minute, and for 10 minutes in succession, 36, 40, 15, 17, 25, 28, 30, 31, 32, and 33 respectively, or an average of about 29 beats per minute.

During the first three minutes after excision, a very interesting phenomenon presented itself. The heart travelled along the moistened plate in the direction of its base, and thus progression as well as pulsation exhibited itself. As I was always prepared for such a movement, the plate on which the heart was laid out had marks to indicate the slightest progress. The distance travelled happened to be the length of the heart itself, viz. $\frac{5}{12}$ inch, and the rate of progression $\frac{3}{12}$ inch the first minute, $\frac{1}{12}$ inch each the second and third minutes.

There is something positively grotesque at first sight in an excised portion of the body, such as the heart, beating away and moving along at the same time, but I had become so familiar with this progressive movement in the excised heart of the frog, that it was to me not an unexpected occurrence.

In the excised beating heart, there is an exhibition of energy which is merely a continuation of the habitual work of the organ, but in the excised moving heart, there is a display of power for which we are unprepared. Just as in the detached gill, labial palp, or foot of the mussel, we might expect ciliary motion to continue, but not necessarily the progressive movement which they exhibit. The cause of this progressive movement in the latter case is evident, being due to the cilia; but how the excised heart is propelled, and why in the direction of base or apex, I leave to others

to determine. This much may be stated generally, that it will be the strong muscular contractions of the ventricular walls which will produce the movement. The fibres there are arranged spirally (at least in higher Mammals), and as each spiral contraction drives the blood forward when the heart is attached, so the force normally employed in doing so is now expended in sending forward towards the base the detached heart itself. The short and sharp contraction of the ventricle might be supposed to give a jerking action to the progressive movement of the heart, and as a matter of fact, in the frog's heart it was so; but here, the heart seemed to glide gently along, as if an intermittent source of energy was converted into a continuous movement.

There is likewise a deep interest attaching to such movement, not only as showing the abounding vitality possessed by the heart, even when out of the body, but as exhibiting in a very appreciable form the force and direction of the heart's energy. In the rabbit and kitten it is the same direction, but in the frog it is mostly the opposite, or apex-ward, and thus there is an important difference in the behaviour of the excised Amphibian heart, as against the Reptilian and Mammalian hearts. There is no occasion to enter into a detailed explanation of this fact now, but it may be noted in passing, that Drs. Waller and Reid* state in connection with their electrical examination of the isolated heart, "all our observations support the theory, that the contraction proceeds from base to apex" in the frog, and "that the contraction begins at the apex and ends at the base of the ventricles" in the Mammals.

Resuming the record of the beats, this was as a rule taken every half-hour. The first half-hour after excision, three successive minutes gave 34, 35, 35 respectively, the beats being very regular and with vigorous stroke. The second half-hour the beating was still regular, but weaker, and 28 beats per minute for three minutes in succession were recorded. Fifteen minutes afterwards, 21 and 20 beats per minute were recorded. The third half-hour the beating was still fairly regular, and ran for five minutes in succession 20, 23, 22, 23, 23 respectively. The fourth half-hour the beating was steady, but feeble, and gave for 5 minutes in succession 17, 15, 16, 16, 16 respectively. The fifth half-hour showed very feeble beating, and a perceptible

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* Phil. Trans., 1887, B. and Nature, Vol. xxxviii, 1888.

exhaustion of energy. In four successive minutes, 10, 12, 14, and 13 beats were recorded. Shortly after, the heart practically ceased to beat, although up to this the entire heart beat—ventricle and auricles—in regular alternation. Ten minutes after the last record there was no visible movement of the ventricle, although five minutes later the left portion of it showed very faint movement, but soon ceased. There were still very faint indications of movement at the junction of the auricles and ventricle, but we may say that the heart ceased to beat as a whole nearly three hours after the administration of chloroform, and two and a half hours after excision. The exact times were:—Chloroform administered 8.15; taken out 8.49; heart excised 9.5; last recorded beat of ventricle (13) at 11.38 and certainly still beating feebly at 11.40; so that the excised heart beat as a whole for 2 hours 35 minutes at least.

The contrast in the time of pulsation between this and the previous heart, is marked, both of which were taken from chloroformed snakes. The former with its auricles beating for 6 hours at least, and its ventricle for fully 3 hours, while the latter only pulsated altogether for about 2½ hours after excision. An explanation, however, lies in the fact, that a large portion of the heart's store of energy was used up in the progressive movement, for it was usually found in the frog's heart that the duration of pulsation was lessened when progressive movement occurred. The temperature was pretty constant throughout at 20° C.

Summing up the principal results obtained, they may be presented as in the following table, which gives only the maximum results in each case:—

TABLE I.

Heart.	Mode of Death.	In Pericardium.	Without Pericardium.	Excised.	Duration of Pulsation of Excised Heart.		Temp.
No.		Per min.	Per min.	Per min.	Hours.	Minutes.	C.
1	Severing spinal cord	9½ beats	8 beats	4½ beats	—	23½	19°
2	Chloroformed	39 ,,	23 ,,	33 ,,	3	4 (at least)	18°-23°
3	Do.	47 ,,	21 ,,	40 ,,	2	35 (at least)	20°

As regards the beats per minute, they vary considerably according to circumstances. The pulse-rate of the snake,

according to Colin,* is 24 beats per minute, or according to Burdach,† 34 per minute, but from the above table, it is seen that this rate is exceeded when the heart of the chloroformed snake is observed, either attached and within its pericardium, or detached.

It may be mentioned that in the chloroformed snakes, the right auricle was distended with blood, while the left was flabby and empty. The explanation usually given, that the heart is distended after death by chloroform, owing to its want of power to contract, is negatived by these observations; for surely it will be conceded, that a heart which can execute movements and pulsate for hours, is not lacking in a considerable amount of stored up energy. But a probable explanation of the fact that the right side of the heart retains its blood, while the left side is deprived of it, lies in this, that the lungs (in this case lung) cease to perform their proper functions, that respiration is arrested, and so blood ceases to be received by the lungs through the pulmonary artery, or from them through the pulmonary veins, although the muscular, still living and active heart, continues to pulsate. And this suggests the question—Can a body be said to be dead entirely, while the heart within it is living and active? Death is the cessation of vital activity, but we cannot say that the progressing and pulsating heart does not exhibit activity of a vital kind, so that somatic death need not include cardiac death. Poets, novelists, and even scientists have spoken of the pulse of the heart being stilled by the gentle hand of death, but there may be death to all outward appearance, and still the heart beats—life at least cannot be said to be extinct. Professor MacAlister, of Cambridge, says‡ that stoppage of the heart and cessation of life are simultaneous in man and the higher warm-blooded animals, but I have observed the excised heart of a kitten to travel ½ inch forward and 1⅛ inch to right, and pulsate as a whole for 5 hours 12 minutes. It seems to me that death can only be accurately defined as stoppage of the heart's action, or rather, if this action be regarded as due to nerve substance, then the death of the nerves, or that part which co-ordinates, would be the final test. At present, however, in the Vertebrata at least, we may speak of partial or somatic death, and complete or cardiac death.

* See Landois and Stirling's Text-book of Physiology.
† Physiologie, Vol. iv, p. 25.
‡ Man, Physiologically Considered. Religious Tract Society.

I may briefly refer in conclusion to the results already obtained from the comparative study of the excised hearts of fish, frogs, reptiles, birds and mammals. As regards the movements of the heart, they are usually stated to be those of pulsation alone, but we have now to add progression and what I have ventured to call rhythmic quivering. This consists of a feeble quivering movement, after the regular visible beating has ceased, and which may last for a considerable time.

The following Table (II) gives the movements of pulsation and progression of excised hearts in the five classes of verebrate animals, with the maximum result obtained in each case :—

TABLE II.

—	1. FISH (Australian Smooth Hound)	2. FROG (Green and Golden Bell Frog)	3. TORTOISE (Long-necked River Tortoise)	4. COPPER-HEAD SNAKE (Young)	5. BIRD (Common Fowl)	6. RABBIT (Young)	7. KITTEN
	Min. Sec.	Hours.	Hrs. Min.	Hrs. Min.	Min Sec.	Min. Sec.	Hrs. Min.
Duration of pulsation	10 20	5 to 6 (at least)	6 23	3 4	1 15	24 50	5 12
Distance traversed	—	$1\frac{1}{8}$ in. in 2 min.	—	$\frac{5}{12}$ in. in 3 min.	—	$\frac{5}{16}$ in. in first few minutes (exact time not recorded)	$\frac{1}{2}$ in. forward, $1\frac{1}{8}$ in. to right, mainly in 2 min.
Direction of progression	—	Apex, & towards left usually	—	Base—straight forward	—	Base, with slight inclination to left	Base, and to right, ultimately nearly transverse

In frog, snake, and kitten, chloroform was used as the means of death, so that these results are strictly comparable. Such investigations have evidently important bearings on all questions relating to the heart, and the nature of its action even within the living body. Incidentally, too, they throw important light on the effects of chloroform upon the heart's action. They show that when the breath is out of the body, the heart may be still beating away and capable of considerable exertion.

The now celebrated Hyderabad Chloroform Commission proved conclusively that, under chloroform, respiration ceased before the heart; for in the entire 571 animals experimented on, including dogs and monkeys particularly, and a few horses, goats, cats, and rabbits, this was invariably the case. Chloroform was, as a rule, administered very freely, and the maximum time the heart continued to beat after respiration ceased was 11 minutes in the dog, and 12 in the monkey. No doubt in the human subject, chloroform is not administered to the healthy, and the highly sensitive heart cannot long survive the death of the body; but making due allowances, the comparative study of excised hearts, justify and support the conclusions of that Committee, that death is not due to failure of the heart's action. And the record of cases of resuscitation, when surgeons have pronounced the patient dead, such as the one mentioned by a Surgeon-major of the Bengal Medical Service in the *Lancet* where he says, "I succeeded after about twenty minutes of the hardest work I ever had," enable us to indulge the hope that deaths from chloroform administered for medical purposes, will become rarer and rarer, especially with the young. The practical conclusion of the whole matter is, that while there is pulsation of the heart, there is hope.

ART. VI.—*On a Nematode found in the Stomach of a Copper-head Snake.*

(With Plate VIII.)

By D. MCALPINE, F.C.S.

[Read June 12, 1890.]

This nematode was found in the stomach of the same snake as was infested with the fluke; it measured about five and a half inches in length, and was of a scarlet colour. Its presence in the stomach may be simply due to the fact that it was taken in with drinking water in the young condition, just as they sometimes enter the human body. Or, the eggs may have entered the alimentary canal through some intermediate host. It lived for several days in water freely exposed to the air, after which it was sent to my friend Dr. Cobb, of Sydney, for identification. He kindly supplied the accompanying drawings on which the following brief description is based:—

The specimen happened to be a female, and since many of the characters depend on the male, it has only provisionally been referred to the genus *Ascaris*.

The size and characteristic scarlet colour have already been mentioned. The body tapers towards each end, and is moderately stout (Fig. 1). The anterior end, of a whitish colour, is terminated by the mouth, which is surrounded by three projecting lips furnished with papillæ (Figs. 7 and 8). These lips are situated as shown in Fig. 6, one directed towards the dorsal surface and provided with two papillæ, and the two other lips sub-median, each with one papilla. The inner margins of the lips are tinged with scarlet, and the space between them is occupied by a shield-like organ (?) likewise coloured scarlet, which however is not shown in the Figure.

The posterior end of the body is rounded off, and near its extremity is the anus, a small transverse slit on the ventral

surface (Figs. 2 and 3). The lateral field is shown both here and near the middle of the body (Fig. 4), and it is seen to widen as the extremity is approached.

The nervous system consists of a ring surrounding the œsophagus, and giving off several nerves to the rest of the body (Fig. 5).

The female sexual apparatus is double, only one side being shown (Fig. 9). The ovary is disposed in longitudinal folds and occupies 37 per cent. of the length of the body. This is succeeded by a seminal receptacle, then a uterus in which eggs were found in the very first stages of segmentation and a vulva or sexual opening a little behind the centre of the body. The eggs are spherical, as shown in Fig. 10.

Finally, a formula is here given for this species, which will supply some necessary particulars for the future systematic placing of this worm.

The nematode formula devised by Dr. Cobb gives in brief compass the various measurements which are characteristic for any species, and indicates at the same time the general form and size of the sexual organs. The formula read from left to right, corresponds to the dimensions from head to tail; and the unit of measurement is not absolute but relative, the length of the worm itself being taken as the standard, and the measurements given in hundredth parts of that length. Thus each number expresses a percentage of the total length of the animal, adult specimens as they appear in profile being always taken. The formula consists of 11 numbers, representing as many dimensions. Ten of these numbers are arranged as fractions, the numerator denoting longitudinal measurements and the denominator giving diameters. The eleventh number at the end is the absolute length of the animal—the standard of measurement. The numbers are always given in the same order, referring to pharynx, nerve-ring, base of neck, vulva, and anus successively, so that the formula is brief yet clear, and comparison is easy with other species.

The formula for the present specimen may be given at first with explanatory names, and we will see how much information is compressed in these eleven numbers arranged in this particular way:—

	Pharynx.	Nerve-ring.	Base of Neck.	Vulva.	Anus.	
Lengths ..	·1	·5	3·6	67^{37}	99·75	= 144 mm.
Diameters ..	·2	·3	·5	1·2	·4	

In the first fraction, referring to the pharynx, the numerator (·1) denotes the distance from the anterior extremity to the base of the pharynx, or buccal cavity, and the denominator (·2) represents the diameter of the body at the base of the pharynx.

In the second fraction, relating to the nerve-ring, the numerator (·5) denotes the distance from the anterior extremity to the centre of the nerve-ring, while the denominator (·3) indicates the body diameter passing through the nerve-ring.

In the third fraction, referring to base of neck, the numerator (3·6) denotes the distance from the anterior extremity to the posterior end of the œsophagus, or base of the neck; or in other words, is the length of the head and neck combined. The denominator (·5) represents the diameter of the body at the point of junction of the œsophagus and intestine, or where the neck joins the body.

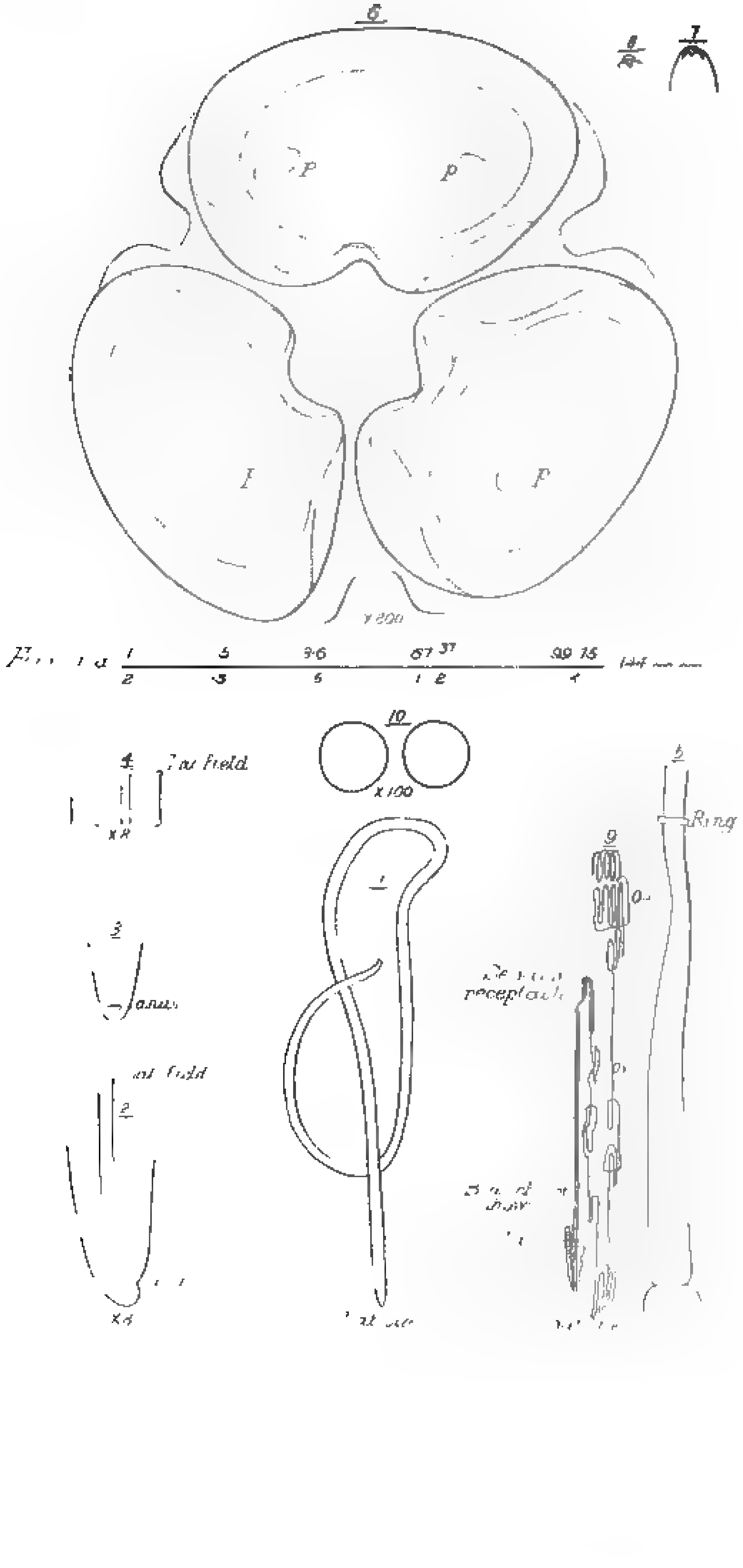
In the fourth fraction, relating to the vulva, the numerator (67) denotes its distance from the anterior extremity, and the denominator (1·2) the diameter of the body there. A further reference is introduced here, placed above and to the right of the numerator, to indicate the percentage of the body occupied by the sexual organs. The number 37 indicates that they occupy 37 per cent. of the entire length of the body, or more than one-third.

In the fifth and last fraction, relating to the anus, the numerator (99·75) denotes its distance from the anterior extremity, and the denominator (·4) the diameter of the body there.

It must be clearly understood that relative dimensions and not absolute measurements are given, for relative and not absolute sizes are of prime importance for systematic purposes. However, if the actual measurements are desired, they may easily be calculated by dividing the body length, 144 mm. by 100, which gives the unit of length for the various parts. This unit is 1·44 mm., and the absolute lengths will be as follows :—

Body length .. .. 144 mm.

Length of head	·144	mm.
Length of neck	5·040	,,
Length from base of neck to vulva ..	91·296	,,
Length from vulva to anus	47·160	,,
Length of tail	·360	,,
	144·	mm.


6
P
p
P
P
x 200
7
8
10
x 100
4
x 8
3
anus
2
x 4
1
5
Ring
9
receptacle

The continuous horizontal line of the formula may be regarded as the animal itself, the numerators indicating the dimensions in length at successive stages from the head end, and the denominators showing how the body thins, or thickens at each successive stage.

Summing up the information conveyed by the formula alone, we have a worm 144 mm. long, somewhat cylindrical in form, and from the base of the neck towards the anterior extremity there is a gradual tapering. In the posterior portion of the body, there is a very considerable tapering from the vulva to the anus, as indicated by the comparison of the figures 1, 2, and 4.

The numerators denote that the head is relatively small; that the nerve-ring is situated towards the anterior end of the neck; that the vulva does not occupy a central position in the body, but is situated in the posterior half; and that the anus is almost, but not quite, at the posterior end of the body.

Only one specimen having been met with, and the male unknown, it would be premature to fix the exact systematic position.

NOTE.—The nematode formula of Dr. Cobb is fully explained in *Ag. Gaz. N.S.W.*, vol. I, part I, p. 131.

EXPLANATION OF PLATE.

All drawn with the camera, except ovary in Fig. 9, which is sketched in.

1.	Ascaris sp. (?)	
2.	„	profile, posterior extremity.
3.	„	ventral view of posterior extremity.
4.	„	near middle, showing width of lateral field.
5.	„	œsophagus and nerve-ring.
6.	„	lips and papillæ (p).
7 and 8.	„	lips.
9.	„	♀ sexual organs, one branch only shown.
10.	„	eggs (spherical).

Art. VII.—*Remarks on a Fluke Parasitic in the Copper-head Snake.*

By D. McAlpine, F.C.S.

[Read June 12, 1890.]

While on a botanical excursion to Oakleigh on 19th April last, in connection with the Field Naturalists' Club, and under the leadership of Mr. French, Government Entomologist, this specimen of copper-head snake was met with and killed on the spot.

On dissecting it a few hours later, for the purpose of studying the beating heart, numerous flukes were found in it of a still undetermined species. Professor Baldwin Spencer* gave a short account of a Pentastomum parasitic in the lung, before this Society, but I am not aware of any flukes having been hitherto recorded. In the lists of Ophidian Trematodes, as far as I am able to trace them, there is no mention of the copper-head snake as a host, so that the determination and description of this one will have to be given more fully afterwards. This fluke is apparently a common one, for on opening another copper-head snake, they were found to be abundant.

Occurrence.—They occupied the trachea and gullet in vast numbers, as well as the lung and anterior end of the stomach. Some of them were moving towards the mouth opening, and were thus free on the interior of the trachea or gullet, while others were adherent to the walls of these organs. A few were found in the mouth, evidently making their way out of the dead body.

It seems to be unusual to find flukes in both the alimentary and respiratory systems, as in none of the snakes to which I can find a reference is this the case. But here they are so numerous in both, that it is difficult to say

* Proc. Roy. Soc. Vic., Vol. I (New Series), 1889.

which is most frequented. They seemed to ordinary inspection quite black, and as many of them were at least a quarter of an inch in length, there was no difficulty in seeing the oral and ventral suckers.

Habits.—As the specimens were numerous and all alive, I had plenty of opportunities of observing their habits. They were seen to move along in the interior of the semi-transparent stomach at a comparatively rapid rate, by extending the body its full length, then fixing the head sucker and contracting to the fullest extent. In this way a continuous progressive movement was kept up. The same movement was seen on placing them in a little water in a watch glass, from which they tried to escape, and the amount of alternate expansion and contraction displayed was considerable. They also sometimes moved to and fro in the water. Usually when taken from the body and placed in a little water, or water and glycerine, they discharged the dark-brown ova in successive jerks sufficient to discolour the water or mixture. Almost invariably when taken direct from the body, and placed in water on a slide under the microscope, they were observed to jerk out the ova with considerable force, from an opening adjacent to, and immediately behind the oral sucker. In its force and suddenness, the discharge seemed like a display of fireworks. In some instances, the brown ova were so completely ejected, as to render the body white-looking to the naked eye, while in others only a very partial discharge took place. It is very instructive to observe the eggs passing out of the body in Indian file, and this can be done leisurely. I placed a specimen on a slide, and a cover-glass over it, so that when gently pressed, a constant stream of ova flowed out, quicker or slower, according to the pressure, and as long as desired.

The ova discharged so near the mouth orifice would frequently fill it, then they would be sucked in and suddenly thrown out and scattered in all directions. Another movement frequently observed under the microscope, was that of apparent feeding. Every now and again, what seemed a long neck-like portion of the body would be stretched forward and the mouth opened at the same time, then the body would contract and the mouth-opening close.

They assumed all sorts of shapes and proportions in moving to and fro, well seen as they moved about on a moistened slide. In water they could remain alive for some time, for several hours at least.

General External Characters.—The flattened body is, as already stated, sometimes over a quarter of an inch in length when fully extended, but varies from that down to one-eighth of an inch, an average size being three-sixteenths of an inch. The tapering anterior and posterior ends are whitish, and the bulk of the body is of a dark-brown, tinged with red, due to the ova principally. The anterior extremity is somewhat rounded, and has the oral sucker on its ventral face. The posterior end is marked by a distinct, projecting, tail-like appendage, flattened out and rounded posteriorly. It is usually protruded, but may be so retracted as to be entirely hidden underneath. The posterior or ventral sucker is generally relatively smaller than the oral, and with the dark back-ground of the body at this place, often stands out with great distinctness. It is situated somewhat behind the middle of the body.

The surface of the body is covered with spines, generally directed outwards or backwards, and sometimes larger than usual on portions of the head end. Towards the posterior end, they are arranged in transverse rows, and curved, with the concave side anterior. Towards the anterior end they seem to be arranged in oblique rows. Usually, in flattened-out mounted specimens, there are no indications of the spines, while in others similarly mounted they stand out with great clearness.

Alimentary System.—The mouth is situated in the muscular head sucker, not in the centre of it, but towards the anterior end. Its natural shape is roundish, but may be transversely oval in mounted specimens. It leads into a pharynx, which very soon enlarges into a thickened muscular body, succeeded by a comparatively short gullet, which is thin-walled. The gullet divides into two branches, right and left—the forked intestine—which pass along either side of the body, and terminate not far from its posterior end. The termination may be club-shaped, or even elongated oval, according to the amount of distension.

Excretory System.—In specimens rendered very transparent by caustic potash, the median tube of the excretory system may be seen towards the posterior end of the body, where the reproductive organs do not conceal it. It enlarges considerably here, then tapers to a fine tube which, towards the very end of the body, may be seen to break up into delicate branches.

Reproductive System.—This is rather complicated, as is usual in hermaphrodite animals.

Male Organs.—The testes are two roundish, or oval, conspicuous, compact, sac-like bodies, on the right and left sides of the body, each inside and slightly anterior to the club-shaped termination of the intestine. Leading from each is a *vas deferens,* both of which pass close together on one side of the ventral sucker, and immediately in front of it merge into the vesicula seminalis. This is an elongated body, extending in an oblique direction, nearly to the hinder part of the oral sucker, where it terminates in a relatively large transversely oval opening. Sometimes the anterior end is protruded, and a glairy-looking mass discharged from the mouth which sticks together.

Female Organs.—These organs collectively form the most prominent feature in the body. The ovary is situated behind the ventral sucker, and the uterus filled with its ova having reddish-brown shell-cases, gives its colour to the bulk of the body. About two-thirds of the length of the body is occupied by it, and it opens at the anterior end just behind the oral sucker, and alongside the termination of the vesicula seminalis. The yolk-glands form numerous dark-grey clusters on either side of the body, extending from a little in front of the ventral sucker to near the posterior end of the body. Their numerous branching ducts unite to form a main duct on either side, and there unite in the middle line. The shell-gland from which the uterus arises, is situated a short distance behind the ventral sucker in the median line. It is a globular glandular mass. The ova are of an elongated oval shape, and the shell opens by a lid.

Details will be given in a future communication.

ART. VIII.—*Note from the Biological Laboratory of the University of Melbourne, on the presence of Corpuscles in the Liquid discharged from the Apertures of the Nephridia and Oral Papillæ of Peripatus.*

By ARTHUR DENDY, M. Sc., F.L.S.

[Read June 12, 1890.]

Recently, while staying with Mr. H. R. Hogg at Upper Macedon, I obtained about a dozen living specimens of *Peripatus*, both the Australian species, *leuckartii* and *insignis*, being represented. The specimens were required by me for anatomical and histological research, and were brought alive to the Biological Laboratory. Not having time to continue my observations at once, I endeavoured to discover the most satisfactory method of killing and preserving the animals for future use. I found that death could be caused instantaneously by holding the animal over chloroform contained in a bottle, without allowing it to come in contact with the liquid. In animals thus killed, I noticed at once a number of drops of a clear transparent liquid which made their appearance at the bases of the legs, in the position of the nephridial apertures, and gradually increased in size. It occurred to me to examine some of this liquid (taken from *P. leuckartii*) microscopically, and on so doing, I was surprised to find that it contained very numerous small amœboid corpuscles, resembling the white corpuscles of human blood, but perhaps a little more irregular in shape. These corpuscles measured not quite 0·015 mm. in diameter; some had numerous, short, slender pseudopodia protruding, some broader ones, and some exhibited a distinct nucleus. The liquid could only be obtained in small quantities, and soon dried up under examination; and, as I had killed nearly all my specimens and placed them in spirits before I began

to examine the liquid in question, I found I had not sufficient material for extended observations upon it. Seeing that the nephridia communicate directly with the body cavity, it seems to me most probable that the liquid containing corpuscles is really cœlomic fluid, expelled from the body cavity through the nephridia under the influence of chloroform, the expulsion being probably due to sudden and strong muscular contraction. We cannot imagine that amœboid corpuscles are a product of excretion, normally discharged from the nephridia, we must therefore believe that they belong properly to the cœlomic fluid, although I am not aware that they have been hitherto observed in the cœlomic fluid of *Peripatus*.

Prompted by these observations, I next, having now unfortunately only a single specimen (*P. insignis*) left alive, placed a drop of the liquid discharged from the oral papillæ of this animal under the microscope. This, also, I found to contain very numerous corpuscles nearly resembling those already described; but as this liquid very rapidly hardens into an enamel-like mass on exposure to the air, I had little opportunity of examining them in the fresh state. It seems probable, however, that these also are amœboid, and since the slime glands do not (so far as is known) communicate with the body cavity, the corpuscles are probably formed within the glands themselves.

Art. IX.—*The New Britain Currency, or Shell-money.*

By R. H. Rickard.

(Communicated by Rev. Lorimer Fison.)

[Read September 11, 1890.]

In this introductory paper I must take, almost without option, the Money, or Currency, of the islanders as my subject, for it is impossible to say much of these people without frequent reference to it.

The New Briton does not merely make money to live, which he must do or die, but he lives to make money. This is true not only of his fishing, planting, canoe-cutting, ornament-making, and of the various employments of his every-day life, but of his fighting and quarrelling, his witchcraft (both offensive and defensive), and of his very recreations—his feasts, his dances, and his secret associations or clubs. He can never get a wife without it, and to be buried without it is to become an evil spirit.

Many customs have their origin in it, *e.g.*, borrowing and lending, pawning, most of the charm-making, besides most of those above named. Hence it will readily be seen that it is necessary that we should know what this money is, before we speak on any of these subjects.

On the Gazelle Peninsula, which is the more important and more populated part of the island, it is called "tabu;" and on the Duke of York Islands, which are twenty miles away, it is called "diwara." It consists of small sea shells of the *Nassa* genus, which are about ⅜ inches in length, and proportionately thick. The back is chipped off so as to make an aperture through the shell. These shells are then strung or threaded closely and firmly in a uniform position on pared strips of cane, or a split vine, about the size of half of an ordinary straw. The latter is used only when the shell is new and the apertures rough and liable to catch on the fibres of the cane. In either case, it is first threaded on short pieces varying from twelve to twenty inches in length, and these are joined by splitting one end of one piece of the cane or vine, and pointing one end of another; the point

of the one is inserted into the split of the other, and shells drawn tightly over the other to hold it fast. In order to draw the shells tightly over the joint, the operator, as he sits, presses his heel on the opposite end of the piece which is split, and then draws the shells one by one towards him. When thus threaded and joined, it is measured off in fathoms and coiled. It is measured by stretching it from extended hand to hand across the chest, so as to make from five to six feet, according to the length of the man's arms. If it be a large quantity belonging to one person, it is generally put aside in coils of ten of these measurements called "pokono," and which for convenience the whites call "fathoms."

A peculiarity of this shell is, that it is not found in any of the localities where it is used as money, but only in a district on the North coast, known as Nakanai, and extending from one hundred to two hundred miles from here, and probably on to New Guinea. The natives gather the shells along the mangrove coast, to the roots of which trees they are found clinging; they collect them and tie them up in pandanus leaves, or the stipule of the betel palm, in sufficient quantities to make from three to six fathoms of "tabu." These parcels are exchanged to the natives of the Gazelle Peninsula for European trade—native ornaments or a kind of native money called "pele" which is made on Mioko, a small island of the Duke of York Group. This "pele" is made of pieces of white or lavender-coloured shell, drilled and strung on cocoanut fibre, then ground round to about the size of telegraph wire, and made up in lengths of from nine to twelve inches. At Nakanai, the "tabu" shells are used extensively for edging collars, armlets, anklets, and other ornaments; for making necklaces, head-dresses, and for ornamenting spears; but they sell much more than they use. The natives of the French Islands, which are nearly one hundred miles away to the North, are largely ornamented with these shells, which they obtain from Nakanai through trading expeditions. Some of these shell ornaments are found amongst the natives of the German Protectorate of New Guinea, but we cannot say whence they procure them. The shells when used for ornaments have more of the back chipped off than when used for "tabu," so as to make them flat; they have also two apertures to admit of being sewn on to ornaments. The natives of the Gazelle Peninsula also use a little of this kind of shell on collars and girdles.

When new, the "tabu" shell is of a dark colour, and strange as it may appear, the people on this side of the island, and on the Duke of York Islands, refuse to accept it as money. The coin new from the mint is repudiated in favour of the old and worn. However, we have not to look far for the explanation. The "tabu" comes from a great distance, and in the past, when communication was more difficult and less frequent than it is now, it was obtained here after it had passed from one person to another, from village to village, and from district to district, being probably years on the way, by which time it had become white, and until late years the people on the East Coast, and on Duke of York never saw the dark kind. The conservative nature of natives is not easily reconciled to anything which is different from that of their fathers. In fact, the most frequent and conclusive argument they use is "It was always so," implying "and it must always be so." White traders have tried in vain to whiten the new shell with chemicals. The "tabu" is worth much more here than it is at any of the places nearer its source, for passing through so many hands, it necessarily becomes dearer. If the traders could whiten the new shell, which they can buy cheaply at Nakanai, so as to pass it here, it would be very remunerative.

To witness the uses and advantages of the "tabu," let us first visit the market. This is either on the beach or on the boundary of two districts, at an appointed place, where the people of two or more small districts meet every third day to buy and sell. Here the women begin to assemble early in the morning, bringing with them burdens more suitable for horses than for human beings—baskets of taro, yam, or betel nut, coils of cane, and various other articles, which they carry on their backs, suspended by a strap passed over their heads. Those who arrive first sweep the grassless market-place, making it perfectly clean, for reasons which will appear in our paper on witchcraft. Soon the place is crowded with (in some instances) hundreds of men and women. The latter sit or squat down with their baskets, and spread out their taro or yams in sixes for sale. Their chatter is almost deafening, while they do a little trading among themselves. The men are standing about in little groups, some talking or joking boisterously, others speaking in a low voice, giving and receiving private commissions most secretly. Two old friends or business acquaintances meet, one of whom takes a bit of "tabu," about an inch

long, and containing eight shells, out of his basket, which he always carries under his arm, and turning to one of the women, buys a parcel containing four or five betel nuts and about a dozen pepper berries, then the friends have a social chew instead of "a social glass." Here are women buying six yams, or six taro, for a piece of "tabu" six inches in length, or forty shells. There is a man with a large fish and a string of small ones, he does not exchange them for yams or taro, but gets half a fathom for the former, and a quarter for the latter, then with part of it he buys his taro and a few parcels of betel nut, enough to last till next market-day, and returns home with the balance in his basket. Yonder is a woman selling lime in little bags of pandanus leaves sewn together, she gets eight shells for each bag. There is another selling eight ripe bananas for seven shells, and cooked taro for six shells each. Here is another selling puddings made of nuts and taro, or young taro leaves cooked in cocoanut milk, at the rate of seven shells per parcel. This man has bought a small packet of parrot feathers for dance decorations or fancy spears, and has given twenty shells for it. So we might note many similar transactions. A roll of cane for fish-trap making, for half a fathom; a fancy spear adorned with feathers, for three-quarters of a fathom. All this we have seen, but we have heard much more. One man pays a deposit on an unborn pig or dog. The beach-man hands his European trade over to a bushman to sell on commission, and the latter bargains with the former to sell his cassowary, or cockatoo, for a commission also. We hear them giving orders and making appointments. How strange it is to hear them calling ten shells five, and eight four, and so with all the numbers. Yes, but it is the custom with "tabu," but with "tabu" only. We hear the names for the various lengths of "tabu," viz., *a tip*, for any amount up to ten shells; *a tip na arip*, twenty shells; *a waratuk*, forty shells; *a bal*, eighty shells, or a quarter of a fathom; *a papara*, a half fathom; *a pokono*, a fathom; *a vuna em tabu*, two fathoms; *a gaina*, three fathoms; *a arip*, ten fathoms. (These names vary in the different districts.)

Now let us go with a trading party from this town to a distant one. See what keen traders these people are. One has brought a stock of betel nut which he bought at the rate of eight shells, to sell again for twelve or eighteen. Another has bought a sucking pig for two fathoms, to sell

for four or five. This man has acquired print and tobacco for his cocoanuts, or his labour, and now comes here to turn them into money—the former for half its length in "tabu," and the latter for its full length in "tabu."

Next, let us follow the trading expedition to a more distant locality. The party numbers about thirty men in five canoes, and are armed with spears and slings, and possibly a rifle or two. The object of their trip is to turn larger articles into money. One buys a canoe for ten fathoms, to sell at home for twenty or more; another buys opossums' teeth for European trade, or at the rate of fifty or sixty shells per hundred, to sell at the rate of one and a half fathoms per hundred; another buys tortoise-shell with a little trade or "tabu," with which to buy a supply of trade for his next expedition. Another buys a slave for four or five fathoms, and sells him, or her, for double the amount, or more; or perhaps the party has been successful in pouncing upon a few unsuspecting men, women, or children shell-fishing on the reef, whom they carry off as slaves. When we have added that a large pig is worth ten fathoms, a woman (for all wives are bought) from ten to thirty fathoms, and that whites readily buy the "tabu" at two shillings per fathom, we shall have a fair notion of its value.

When compared with other mediums of exchange, or of exchanging produce for produce, how convenient the "tabu" is! Compare a New Briton going to buy a wife with twenty fathoms doubled up in a basket under his arm, with the Banyai (Africa) mustering a little herd of cattle or goats, and driving them off to the home of his father-in-law elect. Or compare him with the Marshall Islander, whose money is a large rock with a hole through it, weighing upwards of half a ton, and which is put down near his house, and perhaps never removed, however often it may change owners. How conveniently and accurately divisible is the "tabu!" You may break it off at any length by holding it short and twisting it. It is capable of being lent and returned in exact quantities. It is neither liable to diminution by use, nor admits of counterfeit. It keeps its value because the supply is limited. It is a universal equivalent for all commodities, and everything that is capable of being transferred in commerce has a known money value, even the recently introduced European trade.

The great disadvantage of the "tabu" is its destructibility by fire, to which native houses are so liable. Recently several coils, probably amounting to a thousand fathoms, were destroyed in one house near our home.

It will be evident from what has been said, that the tendency of trade is to cut up the "tabu" into very small pieces. That which has been much used is full of joints, sometimes with only three or four inches between. This, and all the smaller pieces, are re-threaded on new cane, and all "tabu" that is put by is that which has been re-threaded. When a man finds that he has more than he needs for his ordinary business purposes, and enough to make a roll of one hundred or two hundred fathoms, he makes a hoop of cane with fern leaves twisted around it, to which several lengths of "tabu" are bound, and others added till a large coil is made. These coils vary in size from two to five feet in diameter, but the ordinary size is from two to three feet in diameter, and from eight to ten inches thick. These contain from one hundred to two hundred fathoms. They are most convenient in the event of fire or quarrels, the women quickly put their heads through them and run off with them. Persons making up large quantities of "tabu" have private marks, *e.g.*, one threads the claw of a crab, or part of a tentacle of a lobster, or a sea shell on every few fathoms; or instead of threading all the faces of the shells the same way, he threads a small piece here and there through the whole, with the shells face to face, or every second couple face to face. About the locality of our home, it is commonly believed that a certain chief, To Kaiya by name, has become wealthy through witchcraft. Thus, he puts aside shells enough to make up four or five fathoms, then with certain ceremonies, which of course he keeps secret, it increases to ten fathoms. These coils are wrapped up in pandanus leaves, or in the stipule of the betel-palm, or in banana leaves enclosed in nicely plaited cane.

There is an evident danger here, as in other countries, of money being locked up in the hands of the wealthy; but the danger here is greater, as these people have fewer wants, and can almost, if not quite, supply them all from their own plantations, or by the labour of their wives and menials. But there are certain customs, the principal purpose of which appears to be, to keep the money in circulation. To fully describe these would lead us within the scope of future papers, *e.g.*, marriage and funeral ceremonies, but it will be

sufficient for our present purpose to merely name them :—(1) At every funeral, every man, woman, and child has a little given to them. If it be the funeral of a wealthy man, the amount given to chiefs is from two to three fathoms, to other adults a quarter to half a fathom, and to lads an eighth to a quarter. (2) All the women present at a birth get a little "tabu," according to the wealth of the father, from two to five fathoms. (3) A marriageable young man is caught, and held down while "tabu" is distributed to the spectators. (4) The poor man, who has been beggared to buy his wife, has a few fathoms given him by his wife's relatives, first for "house-warming," and afterwards at the birth of the first child. As we consider native customs, we shall see that a man is compelled by public opinion to give, if he has it to give, or can borrow it. Truly there is "nothing for nothing" in this country, but anything and everything for "tabu." It will buy a person out of any difficulty; an adulteress may buy her life for less than ten fathoms; a few fathoms will secure the death of an adult by secret murder, and less than that by witchcraft; and ten fathoms will make a whole tribe an ally in war.

There are no born chiefs here; money alone constitutes a chief, but of course, some are born wealthy, and in that way may be said to be born chiefs. Wealth is power. A young man borrows from a chief either for his marriage or his initiation into one of the clubs or secret societies, and until the debt with interest is paid he is a vassal to the chief, to run on messages, to dig his land, to paddle his canoe, or fight in his battles. A man who has plenty of "tabu" can buy soldiers by the tribe as long as it lasts. On state occasions it is exhibited, and for this purpose coils of "tabu" are hired for the occasion.

Two thousand fathoms may be said to constitute a millionaire, and these are not more numerous than in European countries. But wealthy misers are more numerous by far than among Europeans—men who are mean, and who live miserably, for no apparent purpose other than that of dying rich.

ART. X.—*Notes on Miocene Strata at Jemmy's Point, with brief remarks upon the Older Tertiary at Bairnsdale.*

(With Diagram.)

By JOHN DENNANT, F.G.S., F.C.S.

[Read October 9, 1890.]

At various times, shells have been obtained at Jemmy's Point, but no particular attention was paid to them until a year or two ago, when Mr. Gregson, Land Officer at Bairnsdale, sent a number of species to Professor Tate for identification. Amongst many well known forms, of frequent occurrence in other portions of our tertiaries in Victoria, South Australia, and Tasmania, there were also several new species. The material forwarded indicated that the deposit probably belonged to the upper division of the tertiaries, but the determination of its exact position in the series required not only a fuller collection, but also a careful examination of the strata. It was, therefore, proposed by Professor Tate, when in Melbourne at the beginning of the year, that I should accompany him on a visit to Bairnsdale and Jemmy's Point; and with the welcome addition to our party of Messrs. Sayce and Pritchard, we succeeded in making an enjoyable, as well as a profitable, excursion to these localities. At the request of Professor Tate, I have undertaken to give the results of our researches.

I may say at the outset, that I do not pretend to discuss the general geology of the neighbourhood, our time having been fully taken up in collecting at the fossiliferous sections indicated to us by Mr. Gregson. Some interesting problems connected with the underlying and overlying strata presented themselves, but our stay was too brief to allow of their being fully studied, and they may well be left for local geologists to work out.

On the geological map of the colony, the Jemmy's Point beds are noted as of Miocene age, which is undoubtedly correct. The beds at Bairnsdale, however, are also given as Miocene, but as they are wholly distinct from those at Jemmy's Point, having scarcely a shell in common, it is difficult to see how they can belong to the same geological formation. In some remarks to be made later on, upon these beds, their relative position in the tertiary series will be considered.

On the accompanying locality map, the situation of those sections at Jemmy's Point, which we examined, is shewn. They are all on, or close to, the northern margin of the Reeves River, opposite Rigby, Fraser, and Flannagan Islands, and thus not far from the new Lakes' Entrance. An outcrop, three miles inland, is known to Mr. Gregson, but this we had not time to visit.

At "The Narrows," the fossiliferous strata crop out on the shore line, and extend for a few feet up the side of the bank. A section about three-quarters of a mile inland, on the line of a timber tramway near the Ti Tree Swamp, is slightly but not much higher, and at the horse shoe indentation, opposite Flannagan Island, the fossils were found from the margin of the river up to about forty or fifty feet on the bank.

These are all the outcrops we saw, but I think it highly probable that there are others, both along the shores of Reeves River from Lake King to Jemmy's Point, as well as for a short distance inland. At all the sections, except that at the Ti Tree Creek, blocks of flaggy sandstone were observed, either above or below the fossil beds; and what looked like the same strata shewed a good distance up, on the side of a hill between Jemmy's Point and Flannagan Islands. When in "The Narrows," I concluded that the fossils lay beneath the sandstone, but at the "Horse Shoe," the latter appeared to be inter-stratified with the fossiliferous deposit. I cannot, however, affirm that such is the case, as possibly the *apparent* superior position of the fossils in one part of the section may be otherwise explained.

The bank on the north side of Reeves River reaches to a height of from 150 to 300 feet, and is evidently the old coast line. The islands in the channel are flat and marshy, while the narrow strip of land, which alone separates the river from the ocean, consists principally of low sand dunes. The present coast features are, no doubt, due to the gradual

elevation of the land, the lakes and rivers, (or rather channels as they should be called) being simply formed by the banking back of the water by drift sand from the beach. At a period not very remote, the sea must certainly have washed the northern shore of Reeves River, and also the inland boundary of the Gippsland coast lakes.

The fossils are generally found in a light-colored calcareous sand, which in the "The Narrows" is mixed with clay at the bottom of the bank. In a few places, the shells form a whitish, friable limestone, in which it is rare to get a perfect specimen. Everywhere, indeed, though the shells are abundant, they are fragile, and it requires patience as well as labour to gather a good variety of species. Strong shells, such as *Pectunculus cainozoicus*, *Leda crassa*, *Trigonia howitti*, *Pelicaria coronata*, &c., are not only numerous, but also frequently perfect; the thin delicate shells are often broken, and a whole one, when found, is at once carefully packed in cotton wool as a prize by the collector.

In the following catalogue, the names and distribution of the fossils collected by our party at Jemmy's Point are supplied. The identifications are by Professor Tate, who has aided me in the palæontological portion of my task in the most liberal manner. Duplicates of all the new species are in his hands, and a description of them is to be published shortly.

The total number of species is 116, viz., Gasteropoda 59, Scaphopoda 1, Lamellibranchiata 47, Brachiopoda 1, Polyzoa 2, Cirripedia 2, Echinodermata 1, and Zoantharia 3.

Species found in Jemmy's Point Beds	Eocene: Lower Beds Muddy Creek.	Eocene: Schnapper Pt.	Eocene: S. Australia.	Miocene: Upper Beds. Muddy Creek.	Miocene: S. Australia.	Pliocene: Limestone Creek, Glenelg.	Locality where Living, and Remarks
Gasteropoda.							
Typhis sp.	..	..	..	..	..	..	New species.
Cominella clelandi (Tate)	..	..	..	..	§	..	
Triton sp.	..	..	..	..	..	..	New species (*aff.* T. ovoideus).
Fusus gippslandicus (Tate)	..	..	..	..	..	..	
Peristernia approximans (Tate) ..	..	..	..	§	§	..	
Fasciolaria sp.	..	..	..	..	..	..	(*aff.* F. rugata).
Eburnopsis sp.	..	..	..	..	..	..	New species.
Phos gregsoni (Tate)	..	..	..	..	..	..	
Nassa subbrella (Tate)	..	..	..	§	..	..	
Nassa crassigranosa (Tate)	..	..	..	§	..	..	
Nassa labecula (Adams)	..	..	..	..	..	..	Living in Temperate Australia.
Voluta sp.	..	..	..	..	..	..	New species (*aff.* V. undulata).
Mitra euglypha (Tate)	..	..	..	..	..	..	
Mitra terebræformis (Tate)	§	..	..	§	..	..	
Marginella tuberculosa (Tate) m.s. ..	..	..	..	..	..	..	New species.
Marginella crassidens (Tate) m.s. ..	..	..	..	..	..	..	New species.
Marginella hordeacea (Tate)	..	..	..	..	§	..	
Oliva nymphalis (Tate)	..	..	..	§	..	..	
Ancillaria oryeta (Tate)	..	..	..	..	§	..	Fossil also at Cheltenham.
Columbella simplex (Tate) m.s. ..	..	..	..	§	..	..	
Cancellaria wannonensis (Tate) ..	..	..	..	§	§	..	
Terebra subcatenifera (Tate)	..	..	..	..	..	..	
Terebra sp.	..	..	..	..	..	..	New species (*aff.* T. tristis).

Species found in Jemmy's Point Beds	Eocene. Lower Beds Muddy Creek	Eocene. Schnapper Pt.	Eocene. S. Australia.	Miocene. Upper Beds Muddy Creek	Miocene. S Australia.	Pliocene. Limestone Creek, Glenelg.	Locality where Living, and Remarks
Gasteropoda—*Continued.*							
Terebra simplex (T. Woods) ..	..		..	..	..	..	Fossil also Table Cape, Tasmania.
Terebra geniculata (Tate) *var.* ..	..		..	§	..	..	
Semicassis trinodosa (Tate) ..	..		..	..	..	..	
Drillia cochlearis (Tate) m.s. ..	..		..	..	..	..	New species.
Drillia wanganuiensis (Hutton) ..	..		..	..	..	..	Fossil Pareora and Wanganui Systems, New Zealand.
Drillia kalimnæ (Tate) m s. ..	..		..	..	..	..	New species (*aff.* D. trevori).
Clathurella sp.	..		..	..	..	..	
Surcula sayceana (Tate) m.s. ..	..		..	..	..	..	New species.
Surcula pritchardi (Tate) m.s. ..	..		..	..	..	..	New species.
Surcula sp.	..		..	..	..	..	New species (*aff.* S. pritchardi).
Struthiolaria lirata (Tate) ..	..		..	..	..	..	
Pelicaria coronata (Tate) ..	..		..	§	§	..	
Pelicaria clathrata (Tate) ..	..		..	..	..	..	
Natica ovata (Hutton)	..		..	§	§	..	Fossil Wanganui and Pareora Systems, New Zealand.
Natica gibbosa (Hutton)	..		..	§	..	..	Fossil Wanganui System, New Zealand.
Natica hamiltonensis (T. Woods)	..		..	..	..	..	
Natica auriculata (Tate) m.s. ..	..		..	§	..	..	
Sigapatella undulata (Tate) m s	..		..	§	§	..	
Crepidula monoxyla (Lesson) ..	..		..	..	§	§	Living Victoria, New Zealand. Fossil Pareora and Wanganui Systems, New Zealand.
Crepidula immersa (Angas) ..	..			..	..	..	Living Victoria, South Australia.
Scalaria triplicata (Tate) m.s. ..	..		..	§	..	..	
Turritella acricula (Tate) m.s. ..	..		..	§	..	..	

Species found in Jemmy's Point Beds.	Eocene. Lower Beds Muddy Creek.	Eocene. Schnapper Pt.	Eocene. S. Australia.	Miocene. Upper Beds Muddy Creek.	Miocene. S. Australia.	Plio-cene. Limestone Creek, Glenelg.	Locality where Living, and Remarks.
GASTEROPODA—*Continued.*							
Turritella sp.	..	..	..	..	..	..	New species (*aff.* T. tristira).
Turritella sp.	..	..	..	..	..	..	New species (*aff.* T. tristira, *var.*)
Turritella sp.	..	..	..	§	..	..	Not yet named.
Turritella platyspira (T. Woods) ..	§	..	..	§	..	..	
Turritella murrayana (Tate)	..	..	§	..	..	..	
Cerithium sp.	..	..	..	..	..	..	
Cerithium sp.	..	..	..	..	..	..	
Rissoina bairnsdaleana (Tate) m.s. ..	..	..	..	..	..	..	New species.
Rissoa capistrata (Tate) m.s.	..	..	..	..	§	..	
Leiopyrga cingulata (Tate) m.s. ..	..	..	..	§	§	..	
Trochus sp	..	..	..	..	..	..	
Bankivia maxima (Tate) m.s.	..	..	..	..	..	..	New species.
Ringicula lactea (Johnston) (?)	§	..	..	..	§	..	
Siphonaria diemenensis (Quoy)	..	..	..	..	..	§	Living Southern Australia.
SCAPHOPODA.							
Entalis mantelli (Zittel)	§	§	§	§	..	§	Fossil also Table Cape, Tasmania, and in New Zealand.
LAMELLIBRANCHIATA.							
Barnea tiara (Tate)	..	..	..	§	..	..	
Saxicava arctica (Linn.)	§	..	§	..	§	..	Living Victoria, South Australia. Fossil New Zealand.
Panopaea australis (Sow.)	..	..	..	..	..	..	Living New South Wales, South Australia.
Corbula ephamilla (Tate)	§	§	§	§	§	..	

Species found in Jemmy's Point Beds.	Eocene.			Miocene.		Plio-cene.	Locality where Living, and Remarks.
	Lower Beds Muddy Creek.	Schnapper Pt.	S. Australia.	Upper Beds Muddy Creek.	S. Australia.	Limestone Creek, Glenelg.	
Lamellibranchiata—*Continued.*							
Corbula scaphoides (Hinds)	..	..	..	..	..	..	Living South Australia, New South Wales, North Australia, East Indies.
Myadora corrugata (Tate)	..	..	..	§	§	..	
Myadora brevis (Sow.)	..	§	..	§	§	..	Living South Australia, Tasmania, Queensland, New Zealand.
Myadora praelonga (Tate)	..	..	..	§	..	..	
Myadora tenuilirata (Tate)	§	§	..	§	§	..	
Myochama plana (Tate) m.s.	..	..	..	..	..	..	New species.
Mactra hamiltonensis (Tate)	..	..	..	§	..	..	
Tellina aequilatera (Tate)	..	..	§	§	..	..	
Tellina albinelloides (Tate)	..	..	..	§	..	..	
Tellina decussata (Lam.)	..	..	..	..	..	..	Living Southern Australia.
Zenatiopsis angustata (Tate)	..	..	§	§	..	§	Fossil also Table Cape, Tasmania.
Psammobia hamiltonensis (Tate)	..	..	..	§	..	..	Fossil also Table Cape, Tasmania.
Chione propinqua (T. Woods)	§	..	..	§	..	..	Fossil also Table Cape, Tasmania.
Chione subroborata (Tate)	..	..	..	§	§	..	Fossil also at Cheltenham.
Chione lucolata (Tate) m.s.	..	..	..	..	..	..	New species.
Cytherea submultistriata (Tate)	.	..	..	§	§	..	
Cytherea paucirugata (Tate)	..	..	..	§	..	..	
Dosinia grayii (Zittel)	..	..	..	..	§		Living Chatham Islands, Fossil Pareora and Wanganui Systems, New Zealand.
Chamostrea albida (Lam.)	..	.	..	§	..	..	Living Victoria, South Australia, New South Wales, New Zealand. Fossil also Table Cape, Tasmania.
Lucina quadrisulcata (D'Orbigny)	..	..	..	..	§	§	Living Southern Australia. Fossil Wanganui System, N.Z.

Species found in Jemmy's Point Beds	Eocene. Lower Beds Muddy Creek	Eocene. Schnapper Pt	Eocene. S. Australia.	Miocene. Upper Beds Muddy Creek	Miocene. S. Australia	Pliocene. Limestone Creek, Glenelg.	Locality where Living, and Remarks
Lamellibranchiata—*Continued.*							
Kellia micans (Tate)	..	..	..	§	..	..	
Crassatella oblonga (T. Woods)	..	..	..	§	§	..	Fossil also Table Cape, Tasmania.
Crassatella sp	..	..	..	..	..	..	(*aff.* C. astartiformis).
Cardita spinulosa, (Tate)	..	..	..	..	..	..	
Cardita sp.	..	..	..	..	..	..	*var.* C. spinulosa, or new species.
Cardita trigonalis (Tate)	..	..	..	..	§	..	
Cardita sp.	..	..	..	..	..	..	
Mytilicardia sp.	..	..	..	..	..	..	New species.
Trigonia howitti (McCoy)	..	..	..	§	..	..	
Trigonia acuticostata (McCoy)	..	..	..	§	§	§	Living Bass Strait. Fossil also at Cheltenham.
Nucula tumida (T. Woods)	..	§	§	§	..	..	Fossil also Table Cape, Tasmania.
Leda crassa (Hinds)	..	..	..	..	..	§	Living Southern Australia and Queensland.
Leda vagans (Tate)	§	§	§	..	..	..	
Leda sp.	..	..	..	..	..	..	(*aff.* L. woodsii).
Pectunculus cainozoicus (T. Woods)	§	..	§	§	..	..	
Pectunculus subtrigonalis (Tate)	..	..	§	§	..	..	
Limopsis belcheri (Ad. and R.)	§	§	§	§	§	§	Living Victoria, South Australia, Cape of Good Hope.
Cucullaea corioensis (McCoy)	§	§	§	§	§	§	
Pecten antiaustralis (Tate)	..	..	..	§	§	..	
Pecten subconvexus (Tate)	..	..	..	§	..	..	
Pecten murrayanus (Tate) m.s.	..	..	..	..	..	..	New species. [Zealand.
Placunanomia ione (Gray)	..	..	..	§	§	§	Living South Australia, Tasmania, New South Wales, New
Ostrea arenicola (Tate)	..	..	..	..	§	..	

Species found in Jemmy's Point Beds.	Eocene. Lower Beds Muddy Creek.	Eocene. Schnapper Pt.	Eocene. S. Australia.	Miocene. Upper Beds Muddy Creek.	Miocene. S. Australia.	Plio-cene. Limestone Creek, Glenelg.	Locality where Living, and Remarks.
Brachiopoda.							
Rhynconella baileyana (Tate)	..	..	..	..	..	..	
Polyzoa.							
Salenaria concinna (T. Woods)	§	§	..	..	§	..	Recent also.
Membranipora parvicella (T. Woods) ..	§	..	§	..	..	..	
Annulosa.							
Balanus trigonus (Darwin)	..	..	..	..		..	Living Australia, &c.
Balanus amaryllis (Darwin)	..	..	..	..	§	..	Living Australia, &c.
Annuloida.							
Arachnoides sp.	..	..	..	..	..	..	New species.
Cœlenterata.							
Flabellum victoriae (Duncan)	§	§	§	..	..	..	
Placotrochus deltoideus (Duncan) ..	§	§	§	§	..	§	
Sphenotrochus australis (Duncan) ..	§	§	§	..	..	..	Specimen much worn.

The species of six molluscs in the above list is doubtful, owing to the badly preserved state of the specimens, and the remarks which follow refer only to the remaining 110 species. The number of new species gathered by us was 24, which with 8 others previously discovered by Mr. Gregson, makes a total of 32 new species from these beds. Of the 110 species, 91 are extinct, and 19 are still living. In estimating the age of the deposit by the percentage system of Lyell, it is, of course, allowable to reckon only the Mollusca proper, and therefore, the 8 species at the bottom of the list will be neglected. We thus have 86 extinct, and 16 living species of Mollusca available for calculation. The following is a summary of their distribution in time:—

Extinct Species—		
Ranging from Eocene to Pliocene	.. ..	3 species
,, Eocene to Miocene	.. ..	12 ,,
,, Miocene to Pliocene	.. ..	2 ,,
Recorded from Eocene strata only	.. ..	4 ,,
,, Miocene ,,	.. ..	33 ,,
Restricted to Jemmy's Point beds	.. ..	32 ,,
Living Species—		
Ranging from Eocene to present time	.. ..	3 ,,
,, Miocene ,,	.. ..	8 ,,
Restricted (as fossils) to Jemmy's Point beds	..	5 ,,
Total	..	102

The terms Eocene, Miocene, and Pliocene, are used merely to indicate the relative ages of our various tertiary deposits, as shown by the percentage of recent shells contained in them, and not to imply synchronism with strata so named in Europe. The percentage system of determining the horizon of a bed is, of course, as applicable to the Australian tertiaries as to those in other parts of the world. The Molluscan faunas of Schnapper Point, Jan Juc, Muddy Creek, and the Murray cliffs, are as rich as those from the Paris and Vienna basins, and will afford to the patient collector ample materials for their subdivision into well defined groups. The argument for the percentage method of classifying tertiary strata is very clearly stated by Professor Hutton in an article upon the Wanganui System of New Zealand, from which I quote the following remarks:—

"The value of taking the recent species of Mollusca in a tertiary rock, as a test of its relative age, has sometimes

been called in question. This has arisen, I think, from a misconception of the limits of the method. If it be true that species have gradually changed, or that they have been gradually introduced into an area—which no one doubts—then it must be true that, in each epoch, the nearer we approach to the present time, the nearer must be the resemblance between the fauna of the epoch and that of the present time. Indeed, the same holds good if, instead of assuming gradual change, we assume that the ancient fauna was altered by successive migrations into the area; for it is evident that the percentage test would be of great value here in ascertaining the relative ages of the various migrations; for each migration would bring many species similar to or allied to those now living, consequently the percentage system is of the greatest importance in testing the relative ages of any two sets of beds belonging to the same biological province. But it does not follow that this method can be trusted for correlating with accuracy sets of beds in widely distant areas. On the contrary, different districts have undergone different physical changes, and we have therefore every reason to suppose that alterations in floras and faunas would proceed with unequal rapidity in different parts of the world." *

It was stated above that out of 102 species of Mollusca in the Jemmy's Point beds, 16 are living, which is within a fraction of 16 per cent., and the beds may therefore be confidently referred to the Miocene period. Many more species will, I hope, yet be obtained from the strata; but, judging from the similarity of the gatherings by the members of our party, as well as by Mr. Gregson, this proportion is not likely to be materially altered.

Only one other deposit in Victoria has, so far, been definitely classed as Miocene, viz., the upper beds at Muddy Creek. In South Australia, the oyster beds of the Murray cliffs and elsewhere, are also referred to the same epoch. In both of these, the percentage of recent shells, as calculated from the described forms, is not more than half that given for the Jemmy's Point fossils; but with regard to the Muddy Creek fauna, when the work of naming all the species obtained is completed, the proportion will, I think, be slightly raised. The tertiaries of Australia are perhaps not

* "The Wanganui System," by Captain F. W. Hutton, F.G.S., "Transactions New Zealand Institute" 1885.

sufficiently explored to enable us to make definite subdivisions of the principal groups, but from its high proportion of recent shells, the Jemmy's Point deposit is, undoubtedly, the youngest member of our marine Miocene group yet met with.

There is certainly a strong likeness between the Jemmy's Point and the upper Muddy Creek beds. Out of the 102 Molluscan forms gathered from the former, no less than 47 are found in the latter also. From the South Australian localities we get 10 additional species, making 56 per cent. of shells common to Jemmy's Point, and the other recognised Miocene beds.

In the lower or Eocene* zone of Muddy Creek, which has yielded about 450 species of mollusca, only 16 of the Jemmy's Point fossils are found, and the majority of these are widely distributed shells, and common to the Eocene and Miocene throughout Australia.

At Muddy Creek, the Eocene and Miocene beds are in contact, a circumstance which prevented their distinct character being recognised until lately; but at Jemmy's Point it is of especial interest to note that the Miocene deposit is the only one present.

The Jemmy's Point beds are of course quite separate from the calcareous strata of the Glenelg River, Portland Bay, Jan Juc, Bairnsdale, &c., which are commonly, but I think erroneously, regarded as Miocene by our geologists. In an article read before the Australasian Association this year, I gave my reasons for placing these in the Lower Tertiary or Eocene group. They have been known as Miocene so long, and have been quoted as such in so many geological memoirs, both Australian and European, that it seems almost presumptuous to call in question the correctness of the classification.

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* A confirmation of the opinion expressed by Professor Tate and myself as to the Eocene age of the lower Muddy Creek beds, and their equivalents in South Australia, has recently appeared from the pen of M. Cossman, a Parisian specialist in the Department of Tertiary Gastropods. In reviewing Parts I and II of Professor Tate's "Older Tertiary Gasteropoda," in *L'Annuaire de Geologie Universelle*, Paris 1889, M. Cossman says—"This fauna has an incontestable analogy with that of the Paris basin. M. Tate will probably give us this year a continuation of his grand work; we should see with pleasure this savant establish more frequent affinities with the European species, and with those of the Alabama basin. It is incontestable that the Australian fauna, if it does not contain species in common with these two faunas, occupies at the least a sort of middle place between these deposits, which are so widely separated geographically."

During the last ten or twelve years, however, the data necessary for determining the relative ages of our tertiary deposits have largely increased. An extensive suite of fossils has been collected, not only from the arenaceous and argillaceous, but also from the calcareous beds; added to which, some most important stratigraphical observations have been made on the sequence of the strata by Professor Tate and others. The conclusion to be drawn from the accumulated weight of evidence is, that the calcareous strata to which I have alluded must be referred to the Eocene, and not, as has hitherto been the case, to the Miocene epoch.

In the course of our trip to the Gippsland Lakes, we stayed for some hours at Bairnsdale, and took the opportunity of visiting the fossiliferous section on the banks of the River Mitchell, a few miles from the town. The fossils are contained in a hard calciferous rock, and are extracted with difficulty. During the time at our disposal, we were able to distinguish only twenty-three species, but I trust that, before long, some local geologist will recognise the fine opportunity there is here for collecting, and add largely to this number. I give a list of the fossils obtained, principally for the sake of comparison with those from the neighbouring bed at Jemmy's Point:—

Waldheimia garibaldiana.
Waldheimia insolita.
Waldheimia grandis.
Waldheimia tateana.
Magasella compta.
Ostrea hyotis (?)
Dimya dissimilis.
Pecten gambierensis.
Pecten sturtianus.
Pecten semilævis.
Hinnites corioensis.
Lima bassii.
Lima jeffreysiana.
Spondylus pseudoradula.
Spondylus gæderopoides.
Cucullæa corioensis.
Conus (cast).
Trochus (cast).
Cellepora fossa.
Clypeaster gippslandicus.
Leiocidaris australis.
Deltocyathus viola.
Orbulina, sp.

The only species common to this list, and that given for Jemmy's Point, is *Cucullœa corioensis* which, though most abundant in the Eocene, has yet been found in every part of the tertiary series, from Eocene to Pliocene. Possibly, with further research, a few other shells common to both deposits may occur, but, judging from my experience with similar strata in the west of the colony, the proportion will remain small.

On the other hand, sixteen out of the nineteen species, which are sufficiently well preserved to receive distinctive names, occur also in the Eocene blue clays of Muddy Creek,

the missing ones being *Pecten gambierensis, Hinnites corioensis,* and *Spondylus gœderopoides.* The last two, however, are recorded from equivalent strata in South Australia, while the remaining one is a common shell at Mt. Gambier, and in the Glenelg cliffs.

With such a small number of species, the percentage system of testing the age of the Bairnsdale deposit cannot, of course, be applied, but we are certainly on safe ground in classing it with those beds wherein all, or nearly all, its shells are represented, namely, with the Eocene of Muddy Creek and South Australia.

Map of portion of Reeves River, Gippsland Lakes

Scale :— 80 chains to an inch f = Fossil Outcrop

Art. XI.—*Appendix to remarks on "The Older Tertiary Strata at Bairnsdale."*

By John Dennant, F.G.S., F.C.S.

[Read November 12, 1890.]

Since reading my notes last month on the North Gippsland tertiaries, I paid a short visit to Bairnsdale, and was fortunately able to see another section on the Mitchell River, about two miles higher up the stream than where we gathered the fossils last January. The locality had been previously visited by Mr. D. Clark, B.C.E., who kindly acted as guide on the occasion of my trip.

We drove along the south side of the river, and thence across the Lindenow Flats, till we came just opposite the house of a farmer named Skinner (Parish of Wuk Wuk). Having crossed the river in a boat, we found a fossiliferous bed exposed on the bank, extending from below water level to a height of about ten feet.

The strata consist of a light-coloured, friable, arenaceous rock, in which the shells are frequently well preserved. In the hard calciferous rock lower down the river, the fossils are for the most part casts only, and a perfect specimen is rare. The strata at Wuk Wuk reminded me of the calcareous bands at Muddy Creek, not only on account of the ease of working, but also because of the similarity of the fossils. Upwards of sixty species were obtained, the names of which are supplied in the following list. The species names of a few cannot be given, as although known from Muddy Creek and elsewhere, they have not yet been described :—

Voluta mc'coyii *(juv.)*
Ancillaria pseudaustralis.
Pleurotoma haastii
Cypræa murraviana.
Trivia avellanoides.
Natica polita.
Natica gibbosa.
Turritella acricula.
Turritella (*aff.* **tristira**).
Turritella, 3 species.
Siliquaria squamulifera.
Eulima danæ.

Cerithiopsis sp.
Trochus, 2 species.
Minolia sp.
Hemitoma occlusa.
Cylichna sp.
Umbrella austrina.
Entalis mantelli.
Corbula (? pixidata).
Myadora sp.
Mactra howchiniana.
Chione dimorphophylla.
Cytherea eburnea.
Chama lamellifera.
Crassatella dennanti.
Cardita delicatula.
Mytilicardia compta.
Leda vagans.
Barbatia celleporacea.
Barbatia simulans.
Pectunculus cainozoicus.
Pectunculus mc'coyii.
Limopsis belcheri.
Limopsis aurita.
Macrodon cainozoicus.
Modiolaria singularis.
Dimya dissimilis.
Spondylus pseudoradula.
Lima jeffreysiana.
Lima bassii.
Pecten murrayanus.
Pecten foulcheri.
Pecten zitteli.
Ostrea (? hyotis).
Waldheimia insolita.
Waldheimia garibaldiana.
Waldheima sp.
Terebratulina scoulari.
Cellepora fossa.
Cellepora, several species.
Salenaria, 2 species.
Eupatagus (? murrayanus) cast.
Echinolampus sp.
Monostychia australis.
Leiocidaris australis.
Placotrochus deltoideus.
Sphenotrochus excisus.
Isis sp.
Biloculina depressa.
Orbulina sp.

An inspection of this list shows at once that, just as with the calciferous rock lower down the river, we are dealing with an Eocene, and not a Miocene, deposit. The two sets of strata are practically the same, the difference in the rocks being mainly one of sedimentation. Mr. Howitt, F.G.S., the well known and able geologist, in speaking of these deposits, says, "apparent alternations of hard and soft material arise, I believe, solely from variations of texture, due to local causes."* The noticeable feature of the Wuk Wuk section, is that it yields so many more species than the calciferous rock close at hand, enabling us to determine with the utmost confidence, the particular epoch to which the Bairnsdale limestones belong. It will be remembered that on the Murray cliffs, the friable strata, rich in mollusca, merge gradually into the hard calciferous rock,† and that at Muddy Creek, the lower beds, with their profusion of fossils, either rest upon, or are bounded by, a similar rock.‡ On the Mitchell River, therefore, we have simply another illustration of the close connection, or rather identity, of the two sets of strata.

* Progress Report, No. II, Geological Survey of Victoria, 1874, p. 62.

† Professor Tate, Proc. Roy. Soc. S.A., Vol. VII, p. 39.

‡ Proc. Roy. Soc. S.A., Vol. XI, p. 34.

The list of fossils given represents only a few hours' work by Mr. Clark and myself, but with perseverance, I have no doubt that quite a large collection might easily be made at Wuk Wuk.

Whether it may prove important economically to have our tertiary deposits exhaustively searched, I cannot say, but regarding the scientific value of the investigation, there can be no doubt. The history of Australia in tertiary times is of interest, not only to the geologist, but also to the student of botany, zoology, and other sciences; and in order that this may be fully understood, it is absolutely essential that the deposits known in different parts of the Continent should be referred to their proper horizon.

During the discussion on my paper last month, some questions were asked concerning the strata to the north of Bairnsdale and Jemmy's Point. The required information is contained in a general account, accompanied by a sketch map of the Mitchell River division, given by Mr. Howitt in Progress Reports, Nos. II and IV of the Geological Survey of Victoria, which should be consulted by anyone studying either the tertiary beds of the locality, or the more ancient strata underlying them. In those articles the Bairnsdale limestones are called Miocene, but I have given my reasons, both here and in previous papers, for altering this into Eocene, reserving the term Miocene for the Jemmy's Point beds.

ART. XII.—*The Dukduk Association of New Britain.*

By R. H. RICKARD.

(Presented by REV. LORIMER FISON.)

[Read November 12, 1890.]

Dukduk is the name of a secret association on the Gazelle Peninsula of New Britain, and of the central figure in that association—a man dressed in leaves in imitation of a bird, which (*beo*, bird) it is frequently called. Probably the resemblance was stronger in the past than now, and the figure was in imitation of a cassowary, but the constant rivalry between the originators in the various villages has yearly produced many minor variations. The lower part of the dress is like a petticoat, made of long supple palm leaves, extending from the breast to, or a little below, the knees; around the body the leaves are fastened to a hoop of cane, to which are attached suspenders which pass over the shoulders. The upper part of the dress is a long conoid, the base of which is another hoop sufficiently wide to pass over the shoulders, and covered with more of the above-mentioned leaves, forming a long over-lapping fringe to hide the part where the two hoops meet, and rest one upon the other, and under which the arms are doubled up and hidden, while they hold the whole steady; and also frequently carry a spear projecting behind and before, while the hand is unseen. The part which hides the face is framed with cane, and covered with various things, as leaves, fibres, cloth, &c., worked together as only natives can work them. It is sufficiently open for the man to see his way, but not to admit of his face being seen by anyone a few yards distant. Above the head it forms a spire, often four or five feet long, on which the decorations are the best that native taste and

skill can produce. The whole dress is very bulky, being about three feet in diameter across the hips, and it is so heavy that the suspenders severely chafe the shoulders.

There are two species of this genus of birds—the one we have described with the long head-dress is the Dukduk proper, the other is a Tubuan. The latter differs in appearance from the former only in having a shorter, and consequently less beautiful, head-dress; but he is of inferior rank, and is the worker. The long spire of the former could not be worn inland, as it would constantly come in contact with the over-hanging limbs of trees, vines, &c. The work of the Tubuan is to fight, levy fines, lead in destroying property as a means of punishment, taboo fruit trees and plantations when hired to do so, and to make collections of food and "tabu" (native shell-money), either by stealing or begging.

I have spoken of the Tubuan as "he," but the word means an old woman, and this Tubuan is held to be a female, and as a matter of course among natives is the worker. "She" is said to give birth to the Dukduks, and all Tubuans have female names, except in rare cases, as in one here, where "she" assumed the name of her deceased chief.

These birds and the association have their home, and conduct their business, on a piece of tabooed ground, called a tareu, a few acres in area, generally on the beach. It is taboo to all females and uninitiated males, who may not even pass it in canoes, except at a distance of a mile or two. Many Tubuans, owned by different parties, may have their home on the one tareu, but I cannot find that more than one Dukduk may. Here the dress is kept hung on a post, and appears exactly as when worn. There is always a large house on the tareu, which is the rendezvous for the members, where native politics, scandal, and gossip are discussed. Any member may don the dress, but only the young men do so as a rule; with this on, the young fellow trots, with long springing strides, up and down the beach, or takes an excursion into the bush, whooping all the way, and occasionally pronouncing his or "her" name. Some of the motions, especially those of the head, cannot do other than remind one of the cassowary. The women and uninitiated hide on his approach; if they do not, they are chased, pelted, or robbed by him. Through him or "her" alone does the society communicate with, or operate upon, the outside community. All the association's acts are in the name of the

Tubuan or Dukduk. It often happens that a man, angry with his wife, wives, or female relations, dons the dress himself, and appears before them as the Tubuan to receive "tabu" to appease the angry person, or he may get someone else to do this for him.

The Dukduk is generally admitted to have originated at Cape Gazelle, and it has been suggested by natives that it was begun by thieves, who thus disguised themselves for plunder. Being found lucrative, it was adopted by others, and so spread from place to place, the privilege of being allowed to practise it being paid for. During our residence here, we have known a town to thus purchase it for several hundreds of fathoms of "tabu," the vendor initiating and instructing the purchaser; and in another case, where the purchaser did not conduct it properly, the neighbouring associations enforced a fine upon him. The irregularity in this case, was that of allowing women to cross a part of the tareu. A very old man tells me that it did not exist here when he was a boy, but others think he is mistaken, so the date of its origin is obscure. Its present object is certainly to acquire "tabu," while it affords general amusement, and provides liberal feasts for the members. The shell-money is got from initiatory fees, fines, and renumeration for tabooing fruit trees, &c., as a protection against thieving.

The association is worked thus:—It is started by a person or number of persons becoming members and purchasing the right from an existing one, which instructs the novices. These promotors receive all the profits, *i.e.*, the income minus the working expenses, as of feasts and workmen. Any male may become a member by paying the initiatory contribution, which is large or small, according to his means, or those of his relatives; it varies from ten to one hundred fathoms of "tabu." Candidates generally give as much as possible, in order to be well esteemed in society. There are generally a great many initiated at one time. They are introduced into the tareu by a member of the society, where a great many men are sitting around the clear space in the centre. On their entering, the Tubuan, to whom they are introduced before the Dukduk, smacks them with "her" hand or a stick, which is a signal for the spectators to rush upon them and assault them in the same way, so that they are often very severely treated, the juveniles excepted. Their friends then pay the contribution for initiation to the Tubuan, which varies from ten to twenty fathoms of shell-money; subsequently, they

are introduced to the Dukduk, when from ten to one hundred fathoms more are paid. Then they are set before a spread of the best food procurable, which has been prepared beforehand, and they are not allowed to leave the ground till it is finished, which is generally several days. During this time, they join with the others in all-night singing and dancing, and try on, and perhaps dance in, the Tubuan's dress. This contribution runs the young men into debt, and compels them to work with fish traps, or make plantations in order to obtain "tabu" to clear themselves. There are very few adult males who are not members of the Dukduk, while many boys as young as four or five years are members too, as their relatives fear their being fined for crossing some part of the tabooed ground, or for some precocious remark about the "bird," which would cost more than the initiation fees. This makes men of them, for the uninitiated are laughed at and spoken of as "women," and natives dread sarcasm more than spears.

These large societies in the past found plenty of employment, as they were really the Government in the various towns. Everything that was wrong in their eyes, gave them an opportunity to extort "tabu;" in this sense they were a terror to the doers of such evil as is condemned by native public opinion; but "might" with these natives is generally "right," so that the weak, especially the women, were the victims of their lust for gain. If a woman were known to have a little hoard, it was not difficult to devise an excuse for dispossessing her of it. Thus, I knew a woman who owned a small basket of shell-money; she was accused of the serious crime of laughing at a man in the presence of others which caused him shame; he, being a member of the Dukduk, mustered a party at night to go with the Tubuan to her home, and they took the whole of her wealth.

In petty cases, the Tubuan simply goes to the home and drives "her" spear into the ground, and squats beside it, perhaps to hide "her" legs, which might be recognised by some mark on them, till some shell-money is offered to "her," which, if not sufficient, "she" rejects by turning from it. If a member of the society is near, he goes to the Tubuan and ascertains "her" business. If only women are present, and cannot guess the reason for "her" visit, they send for a man, who is known to be a member, to come and ascertain, for a woman dare not attempt to speak to "her," or even to hint that communication by speech with "her" is possible. In

these cases the members speak to the Tubuan or Dukduk in a whisper. It is taboo for even members to speak aloud to them in public.

In more important cases, a large party, headed by the Tubuan, goes at night to the home of the delinquent, or to that of his more wealthy relative, for compensation. It is often a pretty sight to see perhaps a hundred men with torches wending their way up a hill, while all are whooping, and the Tubuan often interjecting "her" name. Their errand is generally known beforehand, and they are met with the "tabu." If it were refused, the man's house, if he himself escaped, would be torn to pieces or burned, in which case the Tubuan only would be said to have done it. Dreadful violence and license are allowed to the Dukduk or to its representative, the Tubuan. "She" may murder men or women with little or no excuse, and little or nothing is said about it, lest the secrecy of the institution be violated. Its decisions are the *vox populi*, and its strength is the "might" which among natives is undoubted "right." Hence the people fear it to such an extent, that they would rather suffer an unjust fine, than venture to incur its wrath. When the "tabu" is brought forth, it is scrambled for by the crowd; any which the Dukduk owners might get, they would claim in the name of the Tubuan; it is called "tabu na tabaran" (evil spirits' shell-money, *i.e.*, poor man's money).

The owners get fees for tabooing cocoanut trees or plantations, for obtaining fines on behalf of private parties, and for the Tubuan's presence on great occasions. The Dukduk's taboo is greatly valued, as people fear its wrath too much to run the risk of incurring it by stealing what it has prohibited. A great deal of the society's income is from fines for various reasons, *e.g.*, speaking disrespectfully of the "bird," as by implying the truth as to "her" person, by calling its dress "leaves" instead of "feathers," for speaking about it in the presence of women, &c. No one must hint that things are not what they are called, but of course the supposed secrecy is much greater than the real. Any excuse is availed of to fine non-members, *e.g.*, a lad here was fined three fathoms of shell-money for accidentally breaking a member's pipe, which might have been bought for a finger's length.

The Tubuan occasionally makes excursions in quest of fowls, fish, and puddings, for feasts on the tareu.

The N.W. monsoon is the fishing season, and in it most men and boys living near the beach are thus engaged, and in this way they accumulate more or less shell-money ; so when it is near, the Dukduk and Tubuans are said to die. A few days before their death there is generally a public dance, in which the Dukduk and Tubuans take part; then there is a collection on their behalf, which is made by either spreading a cloth on the ground, or carrying it around among the people, and into it men and women throw their contributions of shell-money-pieces, varying from six inches to a yard in length. On the day of the death there is a feast on the tareu, when the dress is all burned, and there is pretended crying, which is all that outsiders know of the sad event. Collectors of curios have tried hard with tempting prices, to buy the head-dresses, but always in vain. Towards the close of the monsoon, when shell-money is more plentiful, these birds, phœnix-like, come to life again amid great ceremony and rejoicing among the members.

In all these things the proverbial proclivity of the native mind to prohibitions is very manifest. In the Dukduk it is taboo for men to have connection with their wives during its preparation, as also to eat food prepared by women, except that which requires but little handling, as whole taro or fowls ; it is taboo to tie or fix in certain ways when making the dress, and other things too numerous to mention are "taboo." In various districts there may be slight differences in these and in other parts of the Dukduk. We have noticed on the North coast it is conducted with much less severity than on this side.

We have spoken of the Dukduk as it was a few years ago, but at the present time it is almost dormant, owing possibly in some degree to the influence of civilisation, but chiefly to the opposition of the whites. This has taken several forms—

(1) That of ignoring their taboos, as by leading their servants or concubines with them, when walking the beach over the tareu. This greatly annoys the men, spoils their craft, makes them ashamed in the presence of their own women, and it demonstrates to the latter the falseness of the consequences which are said to result from it.

(2) That of violence in cases where the Dukduk is the cause of war which interrupts the markets, or where it interferes with their boats, in the crews of which are some non-members visiting or landing at places near the tareu.

A short time ago the owner of a Dukduk was fined by the German Court two hundred fathoms of shell-money, for disturbing the peace of his district. Since then, a Manilla man in the employ of whites was killed by the Dukduk people while he was making a road through a tareu; this led to fighting, and severe consequences for the natives. Thus it has been checked, and it remains to be seen whether it will die altogether, or be conducted with moderation, and so continue more as an amusement than as a means of extortion.

ART. XIII.—*Descriptions of New or Little-known Polyzoa.*

PART XIV.

By P. H. MACGILLIVRAY, M.A., M.R.C.S., F.L.S.

(With Plates IX and X.)

[Read November 12, 1890.]

MENIPEA PORTERI, McG., Pl. IX, Fig. 1.

I have received, from the Rev. Mr. Porter, a single small specimen gathered at Port Jackson, New South Wales, differing in some respects from those from South Australia, described and figured in Transactions of the Royal Society of that Colony, Vol. XII, p. 25. In most of the zoœcia, the fornix is wanting, and in others is small and clavate. The marginal spines are also thicker, and none are furcate.

EUTHYRIS WOOSTERI, n. sp., Pl. IX, Fig. 2.

Zoarium lobed. Zoœcia alternate in longitudinal series, elongated, rounded above; separated by narrow raised lines; surface hyaline, convex; mouth lofty, arched above, contracted at the lower third, the lower lip slightly hollowed; peristome thickened, especially in the lower lip. A large avicularium on one side of the mouth, broad above, with the triangular mandible produced into an acuminate process directed downwards. Posterior surface indistinctly marked with longitudinal grooves, and thickly covered with very narrow, transverse, parallel rows of minute elevations.

Cooktown, Queensland, Mr. W. H. Wooster.

This beautiful species, which I dedicate to its discoverer, to whom I am indebted for many valuable specimens and much information, is readily distinguished by the form of the mouth, the large lateral avicularia, and the peculiar marking of the posterior surface of the zoarium. I do not

know the exact form or size of the zoarium, as the only specimen I have seen is the small lobe figured, part of Mr. Wooster's single specimen.

The genus Euthyris was proposed by Mr. Hincks (Ann. and Mag. Nat. Hist., August 1882), for a species from Western Australia, which he named *E. obtecta.* The essential difference between it and *Flustra* and *Carbasea*, consists in its having a perfectly formed oral aperture, with the opercular flap attached by a distinct hinge, in the same manner as Thairapora, McG., differs from Membranipora. He referred to the same genus, the Australian *Carbasea episcopalis,* Busk, and *Flustra bombycina,* of Ellis and Solander, from Bahama. The former undoubtedly belongs to the genus, as also probably does the latter, so far as can be determined from the brief description and imperfect figure given. The South African *Carbasea bombycina* of Busk (Brit. Mus. Cat. Pol., p. 52, Pl. XLVIII, Figs. 4 to 7), which is certainly not the species of Ellis and Solander, differs essentially in having a true zoœcial pore, similar to that of *Microporella,* and has properly in the Challenger Polyzoa (Pt. I, p. 104) been subsequently made by Busk the type of a new genus—*Onchoporella.* In that work, Busk suggests that his species and *Microporella diadema,* McG., may be dimorphic conditions of the same species, an opinion for which I cannot see any justification. Independently of the difference of colonial growth, a point of comparatively little consequence, the structure and appearance of the individual zoœcia are quite different. In *O. bombycina,* they are very slightly calcareous; there are several perforations on each side in addition to the zoœcial pore, and there are no oral spines or avicularia. In *M. diadema,* the zoœcia are broader, not so convex, in most forms highly calcified, and the avicularia are constant and very characteristic.

MEMBRANIPORA SEJUNCTA, n. sp., Pl. X, Fig. 5.

Zoœcia oval or elliptical, disjunct, connected by tubes irregular in number and arrangement; margin thickened, with about six stout spines on each side, incurving over the front, and nearly meeting in the central line. Avicularia elliptical, with triangular mandibles, situated above the zoœcia in the connecting network of tubes.

Port Phillip Heads, Mr. J. Bracebridge Wilson.

Allied to *M. pyrula*, Hincks, from which it differs in the much smaller size and connection of the zoœcia by tubes, in the same manner as occurs in *Chorizopora*. The spines also are more slender; the first pair are usually nearly erect. The avicularia, moreover, are different, being round or oval bodies, situated above, and distinct from the zoœcia in the network of tubes by which these are connected.

BIFLUSTRA CORONATA, Hincks' sp., Pl. IX, Fig. 3.

Zoœcia large, quadrate; margins thick, strongly granular, sloping to the aperture, which occupies greater part of the area; the upper edge smooth and slightly raised. An avicularium above each zoœcium, directed obliquely or transversely.

Western Australia, Mr. Wooster.

I have only seen a single specimen, growing along with *B. savartii*. It does not seem to differ from that described by Hincks in Ann. and Mag. Nat. Hist., February 1881, from Singapore or the Phillipines. It may be identical with *Membranipora cyclops*, Busk, which I only know from the description and figure in the British Museum Catalogue.

BIFLUSTRA ACICULATA, n. sp., Pl. IX, Fig. 5.

Zoœcia large, elongated, distinct, slightly straighter above, rounded below; margin thick, bevelled inwards, covered with fine-pointed granulations, and with a row of close very fine sharp denticles projecting inwards from the edge of the aperture.

Port Jackson, New South Wales, Rev. Mr. Porter.

BIFLUSTRA SAVARTII, Audouin, Var., Pl. IX, Fig. 6.

Mr. Wooster has sent me some specimens from Western Australia, which I think must be referred to this species. The zoœcia are angular, rather broad, distinctly separated; aperture oval or elliptical, occupying about two-thirds of the length of the cell, deep; a thick granular lamina slopes downwards to the aperture, the edge of which also is denticulate. In some of the specimens there are numerous small avicularia between the zoœcia.

Waters refers *B. delicatula* of Busk, and the zoology of Victoria, to this species, but although closely allied, as previously pointed out by Smitt in the Floridan Bryozoa,

the zoœcia in that form are very much larger and more regular, and I think that on the whole they ought to be retained as distinct species.

MICROPORA ABYSSICOLA, Smitt sp., Pl. IX, Fig 4.

Zoarium encrusting. Zoœcia large, more or less hexagonal, much depressed, separated by raised granular margins; surface granular; aperture (fully formed) arched above, straight below or slightly bulging upwards, with thickened margins, entirely occupied by the operculum. Avicularian cells interspersed among the others, smaller, with the anterior extremity sharply pointed; in the centre, a large somewhat elliptical aperture, covered by a thin membrane, and having articulated at its anterior end a very long setiform mandible, part of which is fringed by a membranous expansion on both sides.

North Western Australia, on pearl shell, Mr. W. H. Wooster.

This has already been described by Hincks (Ann. and Mag. Nat. Hist., February 1881), from Cuba, and considered as the Membraniporidan form of Smitt's *Vincularia abyssicola* (Floridan Bryozoa), an indication which I think is correct. In my specimen, however, the front of the cells is more depressed and more granular than in Smitt's and Hincks' figures. Smitt also describes a thick ectocyst. In one of the zoœcia, where calcification is not complete, it will be seen that the opercular flap is distinct in the inner membrane, which is exposed for a short distance downwards.

The genus Vincularia is one which, so far as I can see, ought not to be retained. It contains a heterogeneous collection, chiefly fossil, of species agreeing only in the erect cylindrical mode of growth. The majority of the species ought to be referred to Membranipora or Biflustra. Among the tertiary Polyzoa of Victoria, species of Membranipora, Biflustra, Cribrilina, Schizoporella, and Lepralia, are remarkable for occurring in the Vincularia form, and in fact form a striking feature of that fauna.

LEPRALIA LATERALIS, n. sp., Pl. X, Fig. 3.

Zoarium encrusting. Zoœcia very large, distinct, ovate, convex, surface tubercular and pitted, except in a narrow space below the mouth; mouth lofty, arched above, contracted at the lower third, peristome thickened and

smooth, especially on the lower lip. Oœcium very small, rounded, pitted and tubercular. A transverse avicularium, with narrow spatulate mandible pointed inwards, about the middle of the zoœcium on one side.

Nichol Bay, North Western Australia, Mr. W. H. Wooster.

LEPRALIA FEEGEENSIS, Busk, Pl. X, Figs. 1, 3.

I have two specimens of this species sent by Mr. Wooster from Nichol Bay, North Western Australia, one on pearl shell, the other on coral. In both, the zoœcia are very large, distinct, separated by grooves, slightly convex, and marked with numerous minute granulations and perforations. The mouth is large, coarctate. In the one on shell, there is in most of the zoœcia, at each upper angle, a sessile avicularium, with a long pointed triangular mandible directed directly inwards above the mouth. There are several oœcia which are large, rounded, prominent, and marked similarly to the zoœcia. In the other specimen, the zoœcia are more irregularly disposed, and differ considerably in size. Many have an avicularium on one side of the mouth, close to the angle of zoœcium, with the mandible much shorter and broader than in the other specimen, and directed upwards. The projection on each side of the mouth is also rather sharper.

Busk (Challenger Polyzoa, Pt. I, p. 144, Pl. XXII, Fig 9), describes the zoœcia as being "completely immersed so as to form an almost level surface, oblong and rectangular, disposed in linear series, surface smooth, and very finely and obscurely punctured." They are figured, however, as separated by well-marked grooves. He also describes the oœcia as inapparent, but does not figure them, and he figures the avicularia as much more slender than in Mr. Wooster's specimens. Busk's specimen was probably younger, and I have no doubt as to the identity of the species. In addition to the Feegee's, it is also recorded from Hong Kong.

SCHIZOPORELLA PULCHRA, n. sp., Pl. IX, Fig. 7.

Zoarium encrusting. Zoœcia irregularly arranged, ovate or elongated, convex, granular, separated by distinct raised lines; mouth lofty, a wide deep rounded sinus, separated by a sharp angle on either side; peristome thickened. Occasionally round avicularia, with semicircular mandibles, on separate areas.

SCHIZOPORELLA INSIGNIS, Hincks, Pl. IX, Fig. 8.

Zoœcia ovate, distinct, hyaline; a row of elevated puncta (occasionally perforations), traversed by a continuous narrow line, enlosing an area on the front, and extending along the margin above the mouth; one or more similar marks on each side below the mouth; on the front of the cell, in the centre of the circumscribed area, is a small white elevation; mouth semicircular with a well-marked deep sinus in the lower lip, the entrance slightly narrowed. Oœcia large, globose, whitish.

Port Wakefield, South Australia, Mr. T. Smeaton.

This, one of the most beautiful species of the genus, has been previously described by Mr. Hincks (Ann. and Mag. Nat. Hist. August 1881), from South Africa. The markings are very peculiar. They are lenticular, divided in halves by a continuous narrow thread-like line; they frequently become perforations. The Oœcium has not previously been described or figured.

SMITTIA OBSCURA, n. sp., Pl. X, Fig. 4.

Zoœcia confluent, indistinct, small, surface covered with perforations and tubercles; mouth with a denticle supporting an avicularium with a rounded mandible. Oœcia globular, sub-immersed.

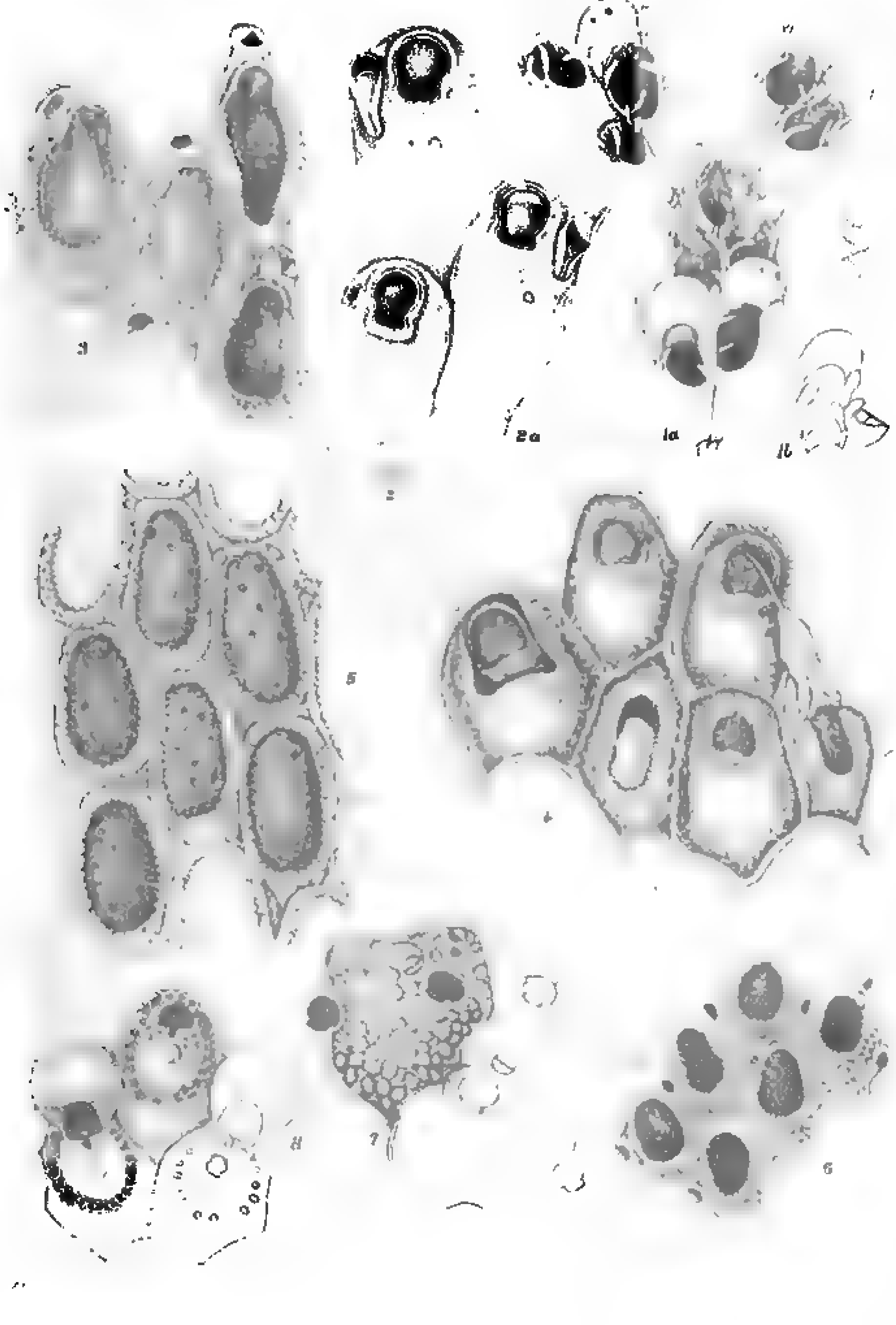
Lorne, Mr. W. H. Wooster.

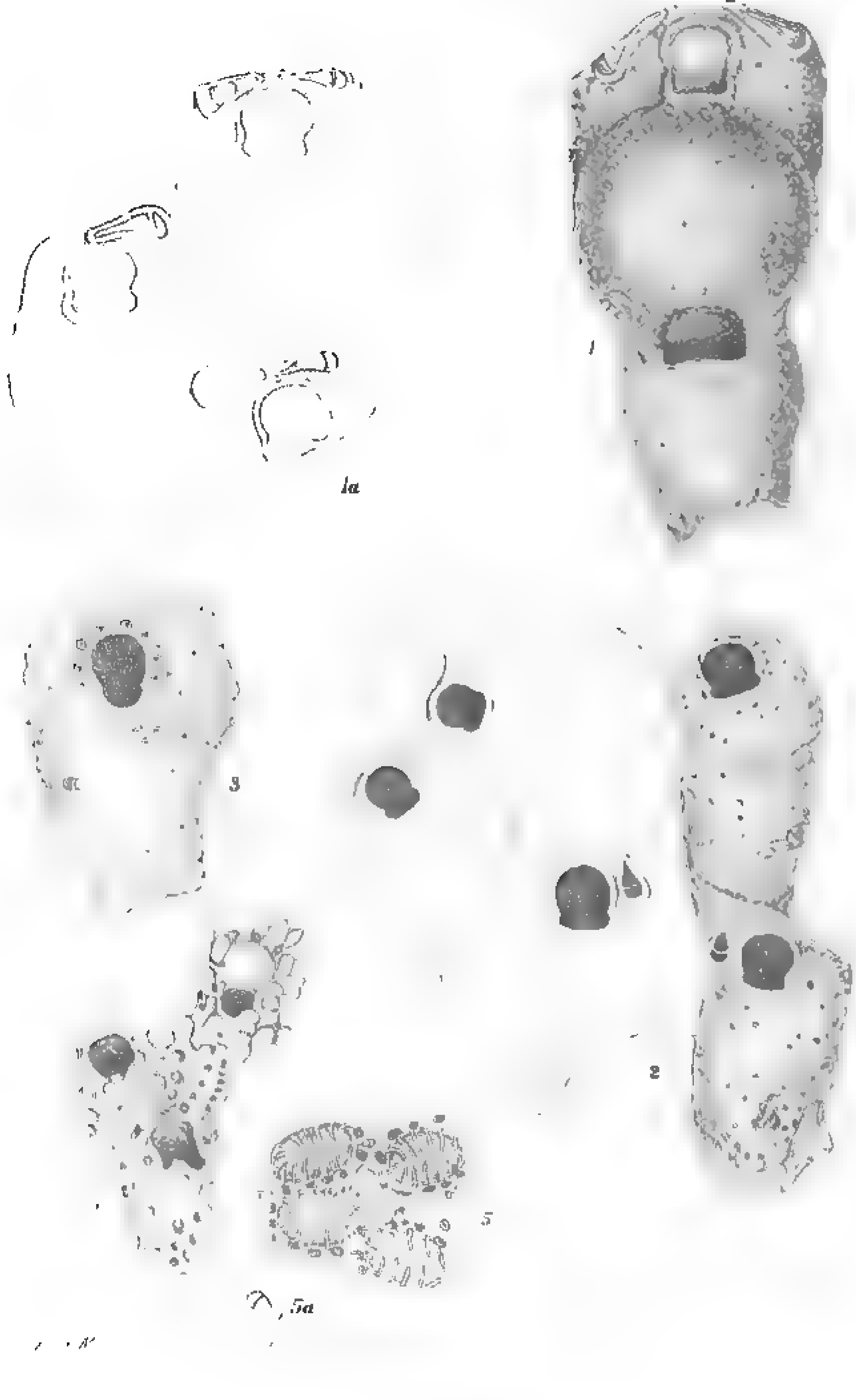
I have only seen a single very small specimen forming a little tube, which has evidently surrounded a sponge or small branch of seaweed. The zoœcia are very indistinct; the surface occupied by round foramina, among which are interspersed calcareous nodules. These nodules are more abundant about the mouth, the form of which they obscure. A small avicularium can, however, be seen on a rounded denticle on the lower lip. The oœcia are small, considerably immersed, without perforations or tubercles.

FASCICULIPORA LÆVIS, n. sp.

Zoœcia very long, united in close bundles, or occasionally single; orifice dimidiate; surface smooth. Oœcia bullate enlargements at the bases of the fasciculi; surface closely punctate.

Victoria, Rev. Mr. Porter.




1a
3
2
5
5a

Of this, I have only seen a single specimen. It consists of a number of fasciculi springing from a common base. These fasciculi vary a good deal; some form closely packed bundles united up to their summits; others are arranged in double rows. A few zoœcia are distinct almost from the base, and in these the orifice is mostly bilabiate.

EXPLANATION OF FIGURES.

Plate IX.

Fig. 1.—Menipea porteri, natural size.
Fig. 1a.—Portion magnified.
Fig. 1b.—Outline of zoœcium and oœcium, showing also avicularium.
Fig. 2.—Euthyris woosteri, natural size.
Fig. 2a.—Portion magnified.
Fig. 3.—Biflustra coronata.
Fig. 4.—Micropora abyssicola.
Fig. 5.—Biflustra aciculata.
Fig. 6.—Biflustra savartii.
Fig. 7.—Schizoporella pulchra.
Fig. 8.—S. insignis.

Plate X.

Fig. 1.—Lepralia feegeensis.
Fig. 1a.—Outline of part of same specimen.
Fig. 2.—Another specimen.
Fig. 3.—L. lateralis.
Fig 4.—Smittia obscura.
Fig. 5.—Membranipora sejuncta.
Fig. 5a.—Avicularium, more highly magnified.

ART. XIV.—*Notes on some Victorian Land Planarians.*

(With Plates XI and XII.)

By W. BALDWIN SPENCER, M.A.

Professor of Biology, University of Melbourne.

[Read December 11, 1890.]

The Planarians, with which this paper deals, were collected during the month of November by the members of a party from the Field Naturalists' Club of Victoria, which had gone out to collect in the country lying between Marysville and the source of the Yarra along the Wood's Point Road.

The country is heavily timbered, has numberless fallen logs, endless gullies, a considerable rainfall, and is eminently suited to planarian life. Certain forms were plentiful, and it may be noticed that these were principally the darker coloured ones, such as *Geoplana spenceri*, which, in parts, was found under almost every log turned over, and two new species to be hereafter described. There was a noticeable absence of the light-coloured species, in which the prevailing body colour is of a yellow tint. Such, in parts of Gippsland for example, are seen crawling about in the open, whilst not one was seen by us in this district of the comparatively common form *G. sugdeni*, and only few examples of *G. mediolineata* and *hogii*. The only light-coloured one at all common was *G. alba*, which showed numerous variations from the typical cream-white colour, the specimens varying from dark cream to a warm shade of brownish flesh-colour, sometimes being even more grey than brown. On only one occasion was a specimen seen crawling out in the open, and this was a *G. spenceri*, climbing a tree, and at a height of five feet from the ground.

Messrs. Fletcher and Hamilton for New South Wales, and Mr. Dendy for Victoria, have named the specimens as yet secured in the two colonies.

In his recent paper, Mr. Dendy* enumerates fourteen species of Geoplana, and one of Rhynchodemus, as found in Victoria. Of these, our party secured seven species of Geoplana, or half the total number, and we were fortunate enough to discover two new species of the same genus, and one found in New South Wales, but not yet recorded in Victoria.

The following is the list of species found by us:—

1. *Geoplana alba* (Dendy).
2. *G. mediolineata* (Fletcher and Hamilton).
3. *G. mc'mahoni* (Dendy).
4. *G. hogii* (Dendy).
5. *G. munda* (Fletcher and Hamilton).
6. *G. sulphureus* (Fletcher and Hamilton).
7. *G. spenceri* (Dendy).
8. *G. dendyi* (sp. n.)
9. *G. walhallæ* (Dendy).
10. *G. frosti.* (sp. n.)

The following is a brief outline of the chief points of interest, together with a description of the two new species:—

Geoplana spenceri (Dendy).—This was undoubtedly the most prevalent species, and seems to be characteristic of this part of Victoria. I found it for the first time under logs by the side of MacMahon's Creek, close to the Yarra; subsequently, Mr. Dendy found it in the same district, and again at Walhalla. Our collecting ground lay in a district intermediate between these two, and from the plentifulness of the worm, it is probable that we were near to the centre of its area of distribution. In regard to colour, there were considerable variations, some specimens having the typical dark, almost green-black dorsal surface, whilst others were of a decidedly lighter colour, varying from dark to very bluish-green, and at times with a slight indication of a median light stripe at the anterior extremity of the body. Though this is interesting as showing possibly a tendency towards *G. cerulea* in colour markings, there was never any difficulty in at once determining the species, and the examination of a far greater number of specimens than has yet been seen of this species, shows that it is a distinctly marked one.

* Transactions Royal Society of Victoria, Vol. II., p. 65.

This animal, together with the other planarians, is very destructive to insect life. It lives under logs with the curious little crustacean 'hopper,' and with various species of coleoptera and myriapoda, and the empty cases of these forms testifies to its voracity. I have watched a *Geoplana spenceri* catch and eat a beetle; the latter inadvertently walked over the worm, and immediately stuck to its slime, then despite its wriggles, the planarian, with comparative speed, wrapped its body round the beetle which was soon enclosed in a slimy mess, and incapable of moving. Then the proboscis was inserted between the joints of the external skeleton, and the planarian fed at leisure.

Geoplana mediolineata (Fig. 15).—Of this species, which is common in parts, we only found one specimen, despite the fact that between us we upturned hundreds of logs, and searched diligently beneath the bark of many gum trees. This species is very variable. In its typical form, it has a single median stripe, with indications at the extremities of the body of two lateral stripes. Sometimes, according to Mr. Dendy, these may be continuous along the body, sometimes they may be wanting, and even the median stripe but faintly present. In our specimen, the median and two lateral ones are well marked, and in addition, there are faint indications of two additional lateral stripes.

Geoplana dendyi, sp. n. (Figs. 1, 2, 3, 4, and 5).—Body long and narrow; greatest length when crawling, 6 inches; width, ¼ inch. When living and at rest, triangular in section, with a prominent mid dorsal ridge (Fig. 1A), and always lies in the form of a coil. The opening into the peri-pharyngeal chamber, in a spirit specimen measuring 2½ inches in length, was at 1½ inches from the anterior extremity. The genital aperture lies half way between the peri-pharyngeal opening and the posterior extremity. Ground colour of the dorsal surface varies from dark to light green,* and at the anterior extremity (Figs. 2 and 4) merges into blue, and this into the orange-coloured tip. Two very light yellow bands pass along the whole length of the dorsal surface, separated from each other by only a thin, but distinctly marked, line of dark body colour. The sides of the body dorsally are covered with light spots absent

* In three fully grown specimens, unfortunately not preserved, the body colour was of a bright ceruloan blue, and the same is true of one small young specimen. The two light stripes on the dorsal surface, and the *triangular* shape of the body, distinguish these from *G. cerulea*.

from a small band-like space on either side of the light lines (Fig. 3). The ventral surface varies in colour in dark specimens, being of the same green colour as the dorsal, with always larger or smaller patches of cerulean blue along the median line. In light-coloured ones, this (Fig. 5) colour may form a band along the greater part, or even the whole length, of the body, and may show indications of a median darker stripe in the mid ventral line.

This appears to be a very distinct species, and was found in considerable numbers under fallen logs, together with *G. spenceri.* It is the most abundant form along the ridge of high land separating the valleys of the Yarra from the Thompson River, and was only found in this district. Seen under the lens, the dark green or bluish skin, with its light dorsal bands and blue-white spots, is perhaps more beautiful than that of any other planarian, and I have much pleasure in naming the species after Mr. Dendy, who has already described some twelve species of Victorian land planarians.

Geoplana frosti, sp. n. (Figs. 6, 7, 8, and 9).—Body when at rest, flattened and leaf-like; when clawling, elongate and tapering equally at both ends. The opening into the peripharyngeal chamber, in a spirit specimen 1 inch long, lay slightly in front of the middle of the ventral surface. The genital aperture lay one quarter of the distance between the peripharyngeal opening and the posterior extremity. The dorsal surface is either dark brown (Fig. 6), or dark green (Fig. 7) in colour, in both cases with a bluish surface tinge, like the bloom of fruit, due probably to the enormous number of blue rod cells lying in the skin. Under the lens, the rods or groups of rods can be seen as fine points. The typical form has two light yellow stripes, separated from each other by a thin median dorsal line of body colour, running from the posterior extremity to the anterior orange tip. The ventral surface is light yellow in colour, though this is almost concealed by brown speckles absent along the median line, where is a well marked band of body colour, visible even in spirit specimens.

This species agrees with *G. dendyi* in its dark upper surface with two light stripes, but can be easily distinguished from the latter by its flattened form when at rest, and its light-coloured ventral surface.

One specimen found was remarkable for the slight development of the light stripes, which were only present at the posterior end, and were continuous with a slightly

lighter band along the median line, which gradually faded away anteriorly (Fig. 8). This specimen also was darker than the rest. It has a strong resemblance at first sight to *G. walhallæ*, but the clear indication of the two light stripes dorsally, and the position of the genital opening, render it distinct from this species.

G. frosti was found only on the high land lying between the upper tributaries of the Yarra and the Thompson River, and even here was not very common; its distribution was practically identical with that of *G. dendyi*. It has been named after Mr. C. Frost, by whom the first specimen was found, and whom I have to thank for valuable assistance in various ways, both on this and on many other occasions.

G. walhallæ, Dendy (Figs. 11, 12, and 13).--This has been already described by Mr. Dendy, who found it at Walhalla, not very far from the district in which we were collecting. It is somewhat leaf-like in shape when at rest, but in this respect forms an intermediate stage between *G. spenceri* on the one hand, and *G. frosti* on the other. When crawling, its upper surface closely resembles the former, from which, however, there is no difficulty whatever in distinguishing it, owing to its light-coloured undersurface, which is covered with brown speckles, as in *G. frosti*, though the median light stripe present in the latter, is here absent. This form and *G. frosti* are undoubtedly more closely allied to one another, than either is to *G. spenceri*, and it is figured here since Mr. Dendy was unable to represent it in the colours of life. Its distribution appears to be extremely limited. We only found one specimen, and this at the spot which we reached nearest to Walhalla.

G. alba, Dendy (Figs. 16 and 17).—This again has been described and figured by Mr. Dendy, and is represented here because the specimens found were of a notably dark colour for this species, to which, at the same time, they are undoubtedly referable. This belongs to the leaf-like forms (when at rest), and specimens vary in colour from almost white to orange, and sometimes brown and grey. The two figured were notable for showing a light median stripe, running the whole length of the body dorsally.

This form is widely distributed in Victoria, being recorded from the hill country extending from Macedon to the East of Mount Ellery, near the borders of New South Wales, in which, however, it has not as yet been found. It is the

most active and rapid in its movements of any planarian which I have yet seen.

G. sulphureus, Fletcher and Hamilton (Fig. 14).—This form has unfortunately not been figured by Messrs. Fletcher and Hamilton, but the description given by them of the colour, and the disposition of the bands, agrees so closely with this form, that it has been thought best to refer it to their species. They describe it as follows:—"Ground colour above and below of a uniformly bright gamboge yellow. In the median dorsal line, a narrow band of ground colour, bordered on either side by a dark reddish-brown line, as wide as the median stripe; external to each of them is a band of ground colour, as wide as the median stripe and its two dark bounding lines taken together; beyond which again, on either side, is an intensely black band, about as wide as the stripe of ground colour, which it bounds externally; the bands become more or less confluent just at the posterior extremity, while just anteriorly, they are obscured by the orange-red tint which colours the anterior extremity."

The specimen* secured by us, agrees (Fig. 14) closely with this description, the outer dark bands being of a dark vandyke brown colour rather than black, and not so wide as those described above, and the ventral surface being somewhat lighter in colour than the dorsal.

This form, in all probability, comes near to *G. hogii*, as described by Mr. Dendy, but the absence of the broad greenish or greyish stripe, characteristic of the latter (typical examples of which we also found), serves to distinguish the two species.

It has not previously been recorded from Victoria, and now makes a total of four species known to be common to the two colonies.

Localities.—Mt. Wilson, Hartley Vale (N.S.W.); ridge between Thompson and Yarra Rivers (Victoria).

Geoplana munda†, Fletcher and Hamilton (Fig. 10).—This has been described by Messrs. Fletcher and Hamilton. The description which they give of its colours, does not exactly tally with the drawing (Fig. 8) given by them, and

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* Since this specimen was described, my assistant, Mr. Mann, has secured two others from another locality, corresponding exactly in colour markings.

† Since the above was written, Mr. Dendy has described a large colony of this form, which he found under a log on the Dandenong Ranges, Victoria. He secured no less than fifty specimens from under this one log, all agreeing closely in colour markings.

from which the animal may be easily recognised. They say, "undersurface greyish in centre, yellowish towards the margins. Above these is a narrow median dorsal line of pale olive brown, bounded on either side by a very fine dark line, external to which is a broader band of a slightly darker brown, and this is boarded externally by a very dark brown line, which gradually merges into a rather broad band of very dark brown, which fades gradually towards its outer margin."

In Fig. 10, the animal is represented for the first time in the colours of life, and may be described as follows :—The body colour is yellow (the tint being that known as Naples yellow), varying in intensity in different specimens, and being always lighter on the ventral than the dorsal surface. On the dorsal surface are, typically, four darker bands of colour. Two of these lie one on either side of the median line, enclosing between them a narrow strip of body colour ; their internal edges are sharply marked, their external ones are less defined. External to the dark lines is a band of body colour, some three times the width of the median stripe, and covered with speckles of brown, which seem to spread out from the dark bands above mentioned, and to gradually diminish in number towards the external borders. External to these light bands lies, on either side, a dark brown band, somewhat wider than the former. Each may be divided into three portions—an upper, median, and lower. The upper has its internal edge sharply marked, and is always very dark ; it passes more or less abruptly into the median part, which has a characteristic speckled appearance, and is bounded externally by the third and lower portion, made up of a somewhat narrow series of dark brown speckles. This lowest part varies somewhat in definition. The four dark bands are always present, but in addition to these, there may be present on either side, just where the dorsal merges into the ventral surface, a linear row of brown speckles, tending to form a dark line along each side. The brown of the bands varies from vandyke to umber.

It is of interest to note that the land planarians, so far as yet known in Victoria, may, with regard to colour markings, be clearly divided into three main groups. The first of these is characterised by a uniform light tint all over the body, varying in different localities from white to orange, or a warm shade of grey. This is represented by the common form *G. alba*, which is found apparently in all parts of

Victoria, having the widest distribution of the known forms. Possibly, from a form similiar to it, the others have been derived.

The second group contains the dark-coloured varieties, in which the upper surface of the body is characterised by its dark colour—either blue, green, or brown. This may again be subdivided into two groups, one of which has a dark, and the other a light-coloured ventral surface.

The third group contains the light-coloured varieties marked dorsally by dark stripes. This again can be conveniently subdivided into two groups, the one of which has a median, and hence an odd number of dark stripes; the other having a median light line of body colour, and hence an even number of dark stripes.

The various forms yet known can hence be tabulated conveniently as follows:—

(*a*) Uniform light tint on upper and lower surface, no dark stripes.

G. alba.

(*b*) Dark tint (blue, green, or brown) on upper surface.

(1) Dark ventral surface—

G. cerulea.
G. spenceri.
G. dendyi.

(2) Light ventral surface—

G. walhallæ.
G. frosti.

(*c*) Light tint (shade of yellow) on upper surface.

(1) Even number of dark stripes—

G. munda.
G. mc'mahoni.
G. hogii.
G. sulphureus.

(2) Odd number of dark stripes—

G. mediolineata.
G. quinquelineata.
G. adæ.
G. lucasi.
G. sugdeni.
G. quadrangulata.
G. fletcheri.

It remains to be seen whether the internal anatomy wi reveal any corresponding relationship amongst the varioı forms.

DESCRIPTION OF PLATES.

PLATE XI.

FIG. 1.—*Geoplana dendyi.* Large specimen × 1½.

FIG. 1A.—*G. dendyi.* Transverse section of body.

FIG. 2.—*G. dendyi.* Enlarged view of anterior end.

FIG. 3.—*G. dendyi.* Enlarged view of surface of the bodɟ to show the spotted nature of the skin.

FIG. 4.—*G. dendyi.* Enlarged view of the anterior enc dorsal view.

FIG. 5.—*G. dendyi.* Ventral surface × 1½.

FIG. 6.—*Geoplana frosti.* Brown-coloured variety, at res × 1½.

FIG. 6A.—*G. frosti.* Transverse section across the body.

FIG. 7.—*G. frosti.* Greenish variety, moving × 1½.

FIG. 8.—*G. frosti.* Dark variety, in which the dorsal ligh bands are feebly indicated. The specimen i this respect approaches *G. walhallæ* × 2.

FIG. 9.—*G. frosti.* Ventral surface × 1½.

PLATE. XII.

FIG. 10.—*Geoplana munda.* Dorsal view × 3.

FIG. 10A.—*G. munda.* Transverse section across the body.

FIG. 11.—*Geoplana walhallæ.* Dorsal surface of animal a rest × 1½.

FIG. 11A.—*G. walhallæ.* Transverse section across body.

FIG. 12.—*G. walhallæ.* Animal in motion × 1½.

FIG. 13.—*G. walhallæ.* Ventral surface × 1½.

FIG. 14.—*Geoplana sulphureus.* Dorsal surface, life size.

W B Spencer del

FIG. 15.—*Geoplana mediolineata*, var. Specimen in which the lateral dark stripes are strongly developed, and forming thus an intermediate variety between *G. mediolineata* and *G. quinquelineata* × 1½.

FIG. 15A.—*G. mediolineata.* Transverse section across the body.

FIG. 16.—*Geoplana alba.* Dark orange-coloured variety, at rest × 1½.

FIG. 16A.—*G. alba.* Transverse section across the body.

FIG. 17.—*G. alba.* Greyish variety of the animal in motion × 1½.

Art. XV.—*Notes on the Marine Rocks underlying Warrnambool.*

(With Two Diagrams.)

By G. S. Griffiths, F.G.S.

[Read August 14, 1890.]

The Borough Council of Warrnambool has recently bored for fresh water in the locality known as Albert Park, one and a half miles from the beach, 160 feet above sea level, and on the north east side of the town. The work was carried out under the supervision of Mr. Richard Bennett, the originator of the scheme, as I am given to understand.

The core brought up discloses an interesting series of sedimentary beds, which appear to have been laid down on a sea bottom, when this locality formed portion of an arm of the sea which extended from West to East, between the Otway Ranges and the Main Dividing Range. In early Tertiary times, Australia was elevated considerably, and the Secondary beds were greatly eroded in the area indicated. With the close of the Eocene, there was a great depression of the surface, and the Jurassic beds of the Otway were cut off from the same rocks of the flanks of the Main Dividing Range by a broad strait. Into this strait, the watercourses opening on its coast-lines brought down sand and mud, clay and chalky ooze, and these were outspread in wide thin beds. To these deposits, coral seems to have been added, for the waters, according to Professor Duncan, were warmer than those of the present seas, judging by the organic remains. These beds were subsequently raised above the sea level, and the Warrnambool bore penetrates the latest deposited, or uppermost of them, to a depth of about 400 feet. What may be the total thickness of these sediments hereabouts, cannot be stated, as there is no indication of proximity to any bottom in the bed of gault in which the boring rod broke; but in another part of this old strait, viz, at Winchelsea, a bore has

penetrated similar sediments for 2100 feet, without touching the Paleozoic bedrock.

A reference to the accompanying table of strata traversed by the Warrnambool bore, and prepared for this paper by Mr. Richard Bennett, will shew that the uppermost stratum consists of 81 feet 9 inches of limestone traversed by flint bands. This rock is of clastic origin, being composed of comminuted shell mixed with silicious sand, and bound together by a calcareous paste, and containing an abundance of flints. It is an ordinary littoral deposit. Mr. Bennett regards it as identical with the æölian limestone so abundant on the coast in the same neighbourhood, which it does resemble, both of them being accumulations of broken shell. I think, nevertheless, that the flint bands of the bore limestone differentiates the two deposits sufficiently. We know that when silicious sand is associated with calcareous sand, and the rock is below the line of saturation, the silica is rendered more or less soluble, and colloid silica segregates out of the mass just as do septaria in clays, and it thus forms flint nodules. This operation cannot proceed in a dry rock, as far as I know, and therefore flint bands in a limestone are evidence of that limestone having been immersed in water.

The æölian coast limestones of Warrnambool do not contain flints, except as remanies, as far as I can ascertain from some slight personal examination, and also from enquiry; and as they are quite recent as to age, and have never been submerged, it is unlikely that they would. The bore limestone on the other hand, was accumulated under the sea, and the flint bands attest this circumstance.

The three next beds in descending order are all clays, either red or yellow. They were deposited when this locality was more distant from the coast line, than it was when the just described and more recent calcareous sand-rock above it was accumulated. The order of superposition is evidence in favor of an elevatory movement, gradually bringing the area into shallower water, so that the deep water clays become buried under shallow water sands.

BED NO. 6. CALCITE, 9 FT. 5 IN. THICK.

This is an uncommon formation. Nearly all limestone is composed of the comminuted remains of shells and corals bound together by calcareous paste; but this massive stratum contains no clastic materials whatever, judging from

the stone composing this part of the core, which has the appearance of having been crystallised out of a saturated solution of mineral salts. Beds of gypsum and rock-salt formed in this way are common, but massive calcite so formed is rare, as far as I can ascertain. This is probably owing to the great solubility of bicarbonate of lime. Calcite is formed in two ways :—(1) In lakes which are drying up, the carbonate of lime being supplied to it by the streams which feed it. Evaporation of its waters tends to concentrate the salts, which are then deposited in crystals on its floor. (2) In nearly closed arms of the sea, such as the Adriatic, which is fed by numerous streams, which cut their courses through calcareous or volcanic rocks. The fresh water being the lighter, spreads out as a thin sheet over the salt water, and is in this way exposed to the evaporating influences of sun and wind, whereby it becomes a concentrated solution, and so deposits its salts as crystals.

The floor of the Adriatic is now being formed of calcite, and this is the explanation given of it by the text books; but I confess that I feel a difficulty in accepting the statement, that there can be sufficient concentration of the waters in the open sea to deposit carbonate of lime.

There is another explanation offered, which is that in the presence of sodium carbonate, lime salts are decomposed, and then calcite is precipitated.

The stratum of calcite in the bore at Warrnambool may have been accumulated in one of these ways. It may represent the bottom of such a lake as those which edge the Ninety Mile Beach in Gippsland, or it might have been deposited in the sea; but it seems to me that in the latter case, that sea must have been a partly closed one like the Adriatic, rather than an open strait like Bass' Strait, in which any sufficient degree of concentration of its waters would hardly be possible. Or again like the Rhone, which has at its mouth a deposit of calcite, the Hopkins which has a course which cuts across volcanic rock and limestone beds, may have poured into this arm of the sea a large volume of water charged with bicarbonate of lime which, coming into contact with carbonate of sodium in the sea water, is reacted upon and precipitated.

Bed No. 8. Light Yellow Marl, 26 ft. 6 in. Thick.

Marl is generally a lacustrine deposit, and is then composed of the mouldered shells of mollusca, and the remains of algæ.

Marine marls generally represent old oyster banks. Either origin is possible for this stratum, as there are no organic remains to be identified in the sample from the bore.

Beds No. 12 and 16. Beds of Green Sand, full of Fossils.

These deposits are of a deeper water type than those just considered, the particles being coated with glauconite. This deposit is generally supposed to indicate a depth of from 100 to 700 fathoms; on the other hand, a species of green-sand is found opposite to the mouths of streams which traverse volcanic country, such as the Hopkins does. In this latter case, the green colour is due to a part of the pyroxene having been changed into chlorite. Such a deposit has been described by Professor Hutton as occurring at Waihao, in New Zealand.

I sent the fossiliferous sand to Dr. MacGillivray, of Sandhurst, for identification, and his report on it is, that there are no undoubted polyzoa in it, although one or two small masses in the parcel sent might be such, but none of the remains were sufficiently distinct to enable him to identify them. There were amongst the broken fossils some small calcareous tubes, which he did not understand the nature of.*

Bed No. 13. Blue Gravel, 22 ft. Thick.

No specimen of this was preserved, but from the description given, I think it may have been derived from slate rock. As no such rock outcrops, as far as I can learn, less than thirty miles away, this deposit must represent a river-borne material, and it must have reached its place of deposit at a time when the coast line was near by, as it would require a current of some swiftness to move it.

Beds 11 and 14. Blue Clays.

This material was probably derived from the same slate rocks that yielded the blue gravel, being the finer washings produced by the grinding up of the pebbles.

* Dr. Dendy, who has seen these fossils, thinks that he can identify them with those of an early Tertiary deposit found in the Isle of Wight.

Beds 15 and 17. Gault, 30 ft. Thick.

These deposits of very fine bluish calcareous clay, must probably have been laid down in comparatively deep water, as the material is so fine that it would settle very slowly; it seems to represent the rainwash of a large area covered with chalk.

Chalk beds, of Eocene age, cover large portions of the South Western corner of Victoria, and in the past they must have been much more extensively outspread. The water-courses have removed large quantities of this rock, and mingled with clay derived from the abundant lava beds, the sediment has been discharged into the sea.

Taking into consideration the nature of the various beds shown in the bore, I think that they indicate a coast line which has been repeatedly shifted throughout the Tertiary. It would be a good thing to have this bore carried down, at least until the Secondary rocks were met with, for it is a fair presumption that the Tertiaries lie immediately upon an eroded extension of the Jurassic rocks of the Otway District.

The Warrnambool Strata as Reservoirs of Artesian Waters.

The economic value of the boring operations deserves some consideration. The Warrnambool strata extend to the North in flat sheets, which rise in that direction at a rate of 35 feet in the mile, and which thin out against the Paleozoic hills at gradually increasing altitudes.

At Hexham, 30 miles distant, almost due North, the Hopkins, descending from the hills, at an altitude of 432 feet cuts its bed through Silurian rock first, then it enters the Tertiary limestones and sandstones which enwrap the older rocks, and which are the inland extensions of the rocks in the bore; and lastly it cuts into the lava which covers up the limestones.

On the North East, at Camperdown, these Tertiary beds rise to about 540 feet above sea level. They reach 731 feet at Penshurst, and 640 feet near Hamilton.

Thus the beds of the upraised Tertiary sea have a regular dip to the South. Fifty miles inland they are found at an altitude of 700 feet, whilst at Warrnambool where they have been pierced, they are 240 feet below sea level, or on a fall of over 1000 feet in that distance. The beds themselves

consist of alternate layers of porous sandstones and gravels, and impermeable clays.

The rain which falls on the land surface for a distance of 90 miles inland, is collected and conducted to the coast by these natural drains. No materials more suited to the purpose of artesian wells are known to occur. On the coast, the sea serves to dam back the fresh waters until they stand permanently a few feet above sea level at a short distance inland. Along the shore line the fresh water wells out in the sands and through rock fissures as spring water.

Near Cape Bridgewater, and a mile or so from the coast, a powerful spring wells up to the surface, and its fresh water was used largely by whalers a few years ago as a convenient source from which to fill their water tanks whilst keeping on the fishing grounds. When the boring rod entered the green-sand at 358 feet (200 feet below sea level), the water rose 225' feet in the tube, soft and fresh in quality.

It seems to me that all the conditions exist here for a good artesian water supply. As the bore goes deeper, it will tap other supplies which come from sources which are further away, and which start at greater altitudes. The hydrostatic pressure in such cases will increase, and probably will suffice to carry to the surface a large supply of good water.

The celebrated artesian well of Grenelle, near Paris, taps its water supply in just such a green-sand bed as that which lies beneath the town of Warrnambool. It would be a pity therefore, were the bore not to be sunk until the requisite water supply is obtained.

Report by Mr. R. Bennett of strata passed through in sinking a bore for artesian water at Albert Park, Warrnambool :—

No.	STRATA.	DEPTH. ft.	in.
1.	Top soil	1	3
2.	Limestone, with flint bands	81	9
3.	Dark red clay	18	0
4.	Bright yellow clay	5	4
5.	Yellow clay and hydrous ferric oxide ...	8	9
6.	Calcite (carbonate of lime)	9	5
7.	Yellow clay, full of angular flint pebbles ...	10	3
8.	Light-yellow marl. (Sea level 161 ft. 3 in.)...	26	6

9.	Coarse Sandstone with bands of flint, full of minute shells	75	0
10.	White sand and white clay	35	0
11.	Blue clay	7	6
12.	Green sand, full of shells and coral-lines ...	14	0
13.	Blue gravel	22	0
14.	Blue clay (soft)	13	3
15.	Gault or chalky blue clay, dry and hard ...	30	0
16.	Green-sand (No. 2 bed), shells and coral-lines, out of which water rose up tubes 225 ft.	10	6
17.	Gault	29	6
	Total depth bored	398	0

MEMO.—A quantity of water rose out of green sand (No. 12), but this was lost in the blue clay and gault. In No. 16, a large body of water was found, which rose up the ubes 225 feet, but on penetrating the lower bed of gault, it stopped here, the machine broke down, and I was unable to get through this bed.—R. B.

MEETINGS OF THE ROYAL SOCIETY.

1890.

[N.B.—The remarks and speeches in the discussions are taken down verbatim by a shorthand writer, and afterwards written out at length with a typewriter, for reference and reproduction, if required; and therefore, more is seldom given herein than an indication of their general drift. If any person should wish to refer to the verbatim report, he can apply to the Secretary to the Society, who will give him an opportunity of perusing and copying it, or if he resides at a distance, so much as he requires will, upon payment of the cost of reproducing it, be forwarded to his address.]

ANNUAL MEETING.

Tuesday, March 13th.

The President (Professor KERNOT) in the chair.

The PRESIDENT announced that the retiring Office-bearers—Professor W. C. Kernot, M.A., C.E., President; J. Cosmo Newbery, C.M.G., B. Sc., Vice-President; E. J. White, F.R.A.S., Vice-President; James Jamieson, M.D., Treasurer; J. E. Neild, M.D., Librarian; H. K. Rusden, Hon. Secretary; and Professor W. Baldwin Spencer, M.A., Hon. Secretary, had been nominated by Mr. White and Dr. Neild for re-election. He understood that Dr. Jamieson was proceeding to England, and was not able to act as Treasurer, but Mr. Blackett had kindly consented to act in his absence.

The retiring Members of the Council had also been nominated by Mr. White and Dr. Neild for re-election. A vacancy had been caused by the lamented death of Mr. Steel, who would have been one of the non-retiring Members of Council on that occasion. T. R. Lyle, M.A., Professor of

Physics at the Melbourne University, had been nominated by Mr. Ellery and himself to fill the vacancy. A letter had been received from Dr. Rudall, who requested that his name should be struck out of the list for re-election, as he found that his professional engagements prevented him from attending the meetings with any approach to regularity. He knew that Dr. Rudall had been very much engaged during the past year, and sometimes had been absent from the Council Meetings, but he had shown his interest by invariably sending an apology, and indeed had been most conscientious in that respect. Still, under the circumstances, they would be compelled to withdraw his name.

Mr. JENNINGS moved, "That the meeting expresses regret that Dr. Rudall should find it necessary to withdraw his name from the list of candidates for re-election, and strongly appreciates the services he has rendered to the Society in the past."

Dr. NEILD seconded the motion, which was put by the PRESIDENT, and carried.

ELECTION OF OFFICE-BEARERS.

In the absence of a demand for a ballot, the retiring Officers of the Society were declared re-elected.

Professor KERNOT returned thanks on behalf of himself and his brother Officers, for the confidence reposed in them. The members might be sure, he said, that during the coming year their Officers would do all they could to forward the interests of the Society.

ELECTION OF MEMBERS OF COUNCIL.

The PRESIDENT stated that by their Rules they were precluded from receiving a nomination that evening, and therefore would have to elect a Council short by one member, and fill up the vacancy caused by the withdrawal of Dr. Rudall, later on, in accordance with special Rules provided for that purpose. The candidates for election were:—R. L. J. Ellery, G. S. Griffiths, Professor Orme Masson, H. Moors, C. A. Topp, and Professor Lyle. As no one desired a ballot, it became his duty to declare these gentlemen duly elected Members of the Council of the Royal Society.

REPORT AND BALANCE SHEET.

The Report and Balance Sheet were read and adopted on the motion of Mr. LLOYD MARKS, seconded by Mr. NEWTON JENNINGS.

The PRESIDENT in putting the motion, said he thought they had reason to be thankful for the record of work during the past year. It would be noticed that the Papers concerned with Biological subjects of interest in Australia, were very numerous, and the Society was doing good work in that direction. This was due to a great extent to the efforts of such gentlemen as Professor Spencer, Mr. McAlpine, and Mr. Dendy.

As this concluded the business, the meeting then resolved itself into an Ordinary Meeting.

ANNUAL REPORT.

The Council of the Royal Society of Victoria herewith presents to the Members of the Society the usual Annual Report for the year 1889. The following were the papers read during the Session:—

On the 14th March, Ordinary Meeting, held after the Annual General Meeting, R. L. J. Ellery, F.R.S., read a brief address on "Recent Progress in Astronomy;" G. S. Griffiths another on "Late Advances in Geology;" Dr. Jamieson a third on "Hygiene," and Professor Masson one on "Chemistry."

On the 21st March, the President gave an account of the most notable recent Engineering Works; Dr. Neild read a paper on Literature and Art, suggesting the formation of Section G; A. H. S. Lucas, reported progress for the Port Phillip Biological Survey Committee.

On the 11th April, A. H. S. Lucas presented the following papers from the Port Phillip Biological Survey Committee:— (1) "On a New Species of Bicellaria," by J. Bracebridge Wilson, M.A.; (2) "On Some New Species of Marine Mollusca, by the same; (3) "The Crinoids obtained in the Port Phillip Biological Survey," by Dr. Carpenter; (4) "Systematic Census of Indigenous Fish hitherto described from Victorian Waters," by A. H. S. Lucas, M.A., F.L.S.; (5) "Additions to the Fish Fauna of Victoria," by A. H. S. Lucas, M.A.; (6) "On the Occurrence of *Krausia*

lamarckiana at Williamstown," by A. H. S. Lucas, M.A.; (7) George Sweet read a paper "On the Old Red Sandstone Rocks and Fossils in the Mansfield District."

On the 9th May, E. J. White read some "Notes upon New Tables for the Barometic Measurement of Heights;" and the President, Professor Kernot, a "Note upon the Explosion of a Boiler in North Melbourne."

On the 13th June, J. Bracebridge Wilson, M.A., read a note on a "Trawling Expedition in the *Lady Loch* Steamer to Cape Schanck;" Professor Spencer read a note on "The Pineal Eye of Mordacia;" and R. L. J. Ellery, F.R.S., presented a paper by G. W. Perry on "Photo-Lithography."

On the 11th July, A. Dendy, M.Sc., read a paper on "The Australian Species of Peripatus;" Professor Spencer read another on "The Anatomy of *Amphiptyches urna;*" and J. J. Fenton read a third on "A French Calculimétre."

On the 8th August, A. Dendy, M.Sc., read a paper on "The Anatomy and Histology of an Australian Land Planarian;" and another paper, presented by J. H. Maiden, F.L.S. (Sydney), on "Liquid Kino," was read by one of the Hon. Secretaries.

On the 12th September, Baron von Mueller presented "Records of Observations on Sir William McGregor's Highland Plants of New Guinea."

On the 10th October, E. J. F. Love, M.A., read a paper on "A Proposed Gravity Survey of Australia;" and E. J. White read another on "Results of Longitudes from Lunar Observations."

On the 14th November, P. H. McGillivray, M.R.C.S., presented part XIII of his "Notes on New and Little-known Polyzoa;" A. Dendy, M.Sc., read a paper on "The Pseudo-Gastrula in the Development of Calcareous Sponges;" and D. McAlpine read one on "The Transverse Section of the Petioles of Eucalypts as Aids in the Determination of Species."

On the 12th December, A. W. Howitt read a paper on "The Organisation of Australian Tribes;" Sidney Gibbons read one on "The Illumination of Public Clocks;" and A. H. S. Lucas' paper on "The Occurrence of a Partially Double-chick Embryo," and Professor Spencer's, on "The Formation of Twins in the Hen's Egg," were taken as read.

Your Committee has to congratulate the Society upon a successful and prosperous year, and to remark that much of that success is due to the exertions and activity of Professor W. Baldwin Spencer. To him are mainly attributable the increase of the Government grant to the Society to £500, which was indispensable to the continuance of the publication of the New Series of the Transactions of this Society; and the pronounced success of the meeting in January of the Australasian Association for the Advancement of Science. The forthcoming Volume of the Transactions of that body will tell its own tale, and it will suffice to state here that 140 papers were read, and that all the details of the arrangements worked most satisfactorily.

Another subject of congratulation is the establishment of Section G, under Law LIII, on the 23rd August. The meetings of the Section were well attended, and have been the means of drawing over thirty new Members and Associates to the ranks of the Society. A remarkable feature in connection with this matter is, that of this unusual accession of Members, eight were ladies.

Your Council was unfortunately deprived of the services on the Council of Mr. E. Bage, almost immediately after his election last year, as he had to proceed to Europe on business in May. Mr. A. W. Howitt was, in July, elected as a Councillor in his place.

The following Members and Associates were elected during the year:—Members—W. H. Archer, R. Barton, Rev. Dr. Bevan, Dr. Bride, J. Cameron (country), F. H. Cole, Harry Edwards (country), W. R. Guilfoyle, F.L.S., E. Jager, Professor H. Laurie, LL.D., Professor T. R. Lyle, M.A., Dr. Wm. Maloney, D. McAlpine, F.C.S., Professor E. Morris, M.A., Miss H. Neild. Associates—Rev. W. Allen, — Baker, Miss Carmichael, Thos. Curry, H. Daglish, E. Davies, Miss Duerdin, D. Falk, Rev. Lorimer Fison, A. Harper, W. W. Harris, J. R. Hubbard, F. N. Ingamells, Hamilton Mackinnon, A. G. Melville, Miss F. Moors, Miss O'Brien, Miss Osmond, Rev. John Reid, J. R. Remfrey, Mrs. Riddell, J. Steele Robertson, B.A., Dr. Ross, T. A. Sisley, F. Slade, Frank Tate, E. A. Vidler, Mrs. R. B. Way.

Your Council regret to have to record the loss by death of several old and valued Members:—The Rev. J. E. T. Woods, Rev. Dr. FitzPatrick, Mr. W. H. Steel (who was a Member of the Council), Dr. H. C. Wigg.

The Librarian reports the addition to the Library, during the year, of the following publications :—From England 196 parts, Scotland 22, Ireland 10, Germany 99, Austria 41, Switzerland 3, France 25, Italy 61, Spain and Portugal 16, Holland and Belgium 61, Denmark 6, Sweden 32, Norway 2, Russia 34, Roumania 1, India 9, Mauritius 3, China 3, Japan 5, Canada 6, United States 40, Mexica and Guatemala 28, Argentine Republic 3, Victorian 142, New South Wales 28, South Australia 5, Queensland 57, Tasmania 11, New Zealand 7. Total publications received, 956.

Dr. *The Hon. Treasurer in Account with the Royal Society of Victoria to March 1, 1890.* **Cr.**

	£	s.	d.	£	s.	d.
To Balance from 28th February, 1889				£192	14	10
,, Government Grant—						
Balance of Vote for 1888-89	£150	0	0			
First Instalment for 1889-90	50	0	0			
				200	0	0
,, Entrance Fees				29	8	0
,, Subscriptions for 1889	260	8	0			
,, ,, 1890	8	8	0			
Arrears	37	16	0			
				306	12	0
,, Rent of Rooms				17	0	0
,, Sale of Transactions				0	17	0
,, Interest				20	0	0
				£766	11	10

	£	s.	d.
By Printing and Stationery	£152	9	8
,, Port Phillip Biological Survey	2	4	0
,, Rates	4	15	0
,, Gas and Fuel	8	5	11
,, Salary of Assistant Secretary	62	18	4
,, Shorthand Records	33	3	0
,, Hall-keeper	9	6	0
,, Collector's Commission	38	3	7
,, Insurance	3	10	0
,, Secretary's Postages	41	15	7
,, Repairs and Furnishing	46	11	11
,, Books and Periodicals	46	0	7
,, Freight	2	10	0
,, Refreshments	3	4	6
,, Treasurer's Postages and Petty Cash	3	14	5
,, Balance, 28th February, 1890	307	19	4
	£766	11	10

Compared with the Vouchers and Bank Pass-book and Cash-book, and found correct,

JAMES JAMIESON,
HON. TREASURER.

28th February, 1890.

(Signed) H. MOORS,
JAS. J. FENTON, } AUDITORS.

PUBLISHING AND RESEARCH FUND.

Dr.				Cr.			
To Fixed Deposit in Bank	£300	0	0	By Fixed Deposit in Bank of Australasia	£300	0	0
,, Interest on same	12	0	0	,, Interest transferred to General Account	12	0	0
	£312	0	0		£312	0	0

STATEMENT OF ASSETS AND LIABILITES.

ASSETS.							LIABILITIES.			
To Entrance Fees (12)				£25	4	0	By Two Debentures	£10	0	0
,, Unpaid Subscriptions for 1890				394	16	0	,, ,, ,, (Interest Unclaimed	8	8	0
,, ,, ,, (arrears)				100	0	0	,, Estimated Unpaid Accounts	200	0	0
,, Rent of Rooms				20	0	0	,, Balance 28th February, 1890	6637	4	8
,, Hall, Library, and Furniture				5000	0	0				
,, Balance of Grant for 1889-90				375	0	0				
,, Two-thirds of Grant for 1890-91				332	13	4				
,, Publishing Fund	£300	0	0							
,, General Account Balance	307	19	4							
				607	19	4				
				£6855	12	8		£6855	12	8

APPENDIX.

(1) Report of Section G (Literature and the Fine Arts).

I beg leave to report the continuous increase of numbers and interest in the Section. There are now seventy members of the Section, of whom forty-four have become Associates or Members of the Royal Society, for the sake of being Members of the Section.

The meetings have been well attended, the average being over forty.

The suggestion made by Mr. Archer last year, that some of Turner's sketches, now entombed in the vaults of the National Gallery, London, should be obtained on loan, if not permanently, for the instruction of students of landscape in the Art Schools of Victoria, has been revived by the Committee, and the sanction of the Council has been obtained to the taking of measures to secure them. Series of them, adapted to the object proposed, are understood to be obtainable, and would prove of the highest value to our rising local artists. It is much to be desired that the negotiations in this direction may be crowned with success.

Since the last report, at the meeting on the 24th November last, Mr. Rusden read a paper on "Parables." The next meeting was on the 28th February, when Mr. Ernest Jäger read the first of a series of papers on "The Orchestra, its Material, and How to Listen to It." On the 28th March, Mr. Sisley read a paper on "Affectations of Poetry." On the 25th April, Mr. Sutherland opened a discussion upon "Tennyson." On the 23rd May, the Rev. E. H. Sugden read a paper on "Dr. Murray's New English Dictionary;" and Mr. Archer another on "Professors of the University and Colonial Civilization." On the 27th June, Mr. Jäger read the second of his papers on "The Orchestra." On the 25th July, Dr. Neild read a note on "A recent Humourist, Jerome K. Jerome;" Mr. Sutherland read "Some Remarks on Alfred Domett, a New Zealand Poet;" and Mr. Rusden "A Note on Fiction." At the following meeting, on the 22nd August, Miss Blair read to an audience numbering sixty, "A Few Good Words for the Storyteller." On the 26th September, Mr. Geo. Gordon McCrae read a paper

type of Calcisponge structure, which Dr. Dendy proposes to describe under the name *Synute pulchella.*

In the last report which he sent to Mr. Wilson, Professor Agardh gives the following additions to our Algal flora :—

Dasya wrangelioides.
Epymenia angustata.
Callithamnion (species nova).
Dilophus fastigiatus.
Taonia atomaria.
Zonaria stuposa.
Udotea (species forsan nova).
Rytiphlœa elata.
Dasya (species forsan nova).
Caulerpa papillosa.
Caulerpa vesiculifera.
Laurencia elata.
Lenormandia chauvinii.
Polysiphonia pectinata.
Epymenia halymenoides.
Polysiphonia spinosissima.
Callithamnion laricinum.
Ectocarpus (species ?)
Callithamnion latissimum.
Polysiphonia (species forsan nova).
Pollexfenia nana.
Griffithsia corticata.
Ectocarpus (species nova).
Wrangelia setigera.
Callithamnion divergens.
Cladostephus spongiosus.
Delesseria marginifera.
Codium elongatum.
Martensia elegans.

Amongst the more interesting forms of life met with during the year have been :—

The rare shark, *Parascyllium nuchale,* McCoy, obtained by Mr. Gabriel.

Argonauta oryzata, great numbers of which were met with, first at Portland, and reaching the inner shores of Port Phillip at Brighton, St. Kilda, &c., about Christmas time.

A. H. S. LUCAS,

Hon. Secretary and Treasurer.

March 2, 1891.

ORDINARY MEETING.

The minutes of the last Ordinary Meeting were read and confirmed.

Mr. Geagher signed the Roll book of the Society, and was introduced to the Meeting.

Mr. Ludovico Hart, and Mr. P. E. Woolf were nominated as Associates.

ETHNOLOGICAL SECTION.

The PRESIDENT stated, with regard to Mr. Woolf, that he was a gentleman accredited from important bodies in Europe interested in Ethnology and had already submitted to the Society a proposal for the establishment of an Ethnological Section of the Society. The Council had approved of the suggestion, and he had now to commend to the members this new Section. The laws of the Society gave them the power to form such a Section, and it was hoped that it would be formed, and do good work. It would be called "Section E." The reason for its formation was that, at the present time, traces of the Aboriginal races were growing fainter and fainter. They were rapidly passing away—their customs were being forgotten, and their productions, in the way of instruments, would shortly be no longer obtainable, and already there was some doubt as to the authenticity and exact object and purpose of the articles exhibited in our various Museums. It was thought that an Ethnological Section would be able to save from oblivion many interesting facts and relics connected with Aboriginal races—races which were doomed to disappear, and which were rapidly disappearing. They, and they alone, could do this work, and if they omitted to do it, the information would be lost for ever. That was the object of the formation of an Ethnological Section. The gentlemen most interested in Ethnology were Mr. Howitt and Mr. Fison, and their co-operation had been secured. There were collections of Aboriginal weapons and instruments at the Public Library and elsewhere, and if the Section could do anything in the way of getting these classified, good work would be done. A doubt had been suggested in many quarters as to the authenticity of some, and it was desirable that those that were not original should be eliminated, so that they would have genuine collections properly arranged and described. This was the object of the Ethnological Section, and it was a Section which certainly had opportunities for doing very good work.

Mr. JENNINGS drew upon the blackboard the outline of some curious battle axes, which he had obtained from an Aboriginal tribe in India. He believed they were still in India, and he would write for them, and give them to the Society.

The PRESIDENT said that this would be a matter of interest to the Ethnological Section. It was proposed that the work of that Section should be the obtaining of authentic specimens of native weapons, not only from our own Aboriginals, and those of the South Seas, but other parts of the world. It had been suggested that the Ethnological Section of the Society should first of all undertake the work of collecting unquestionably genuine Victorian or Australian Aboriginal weapons and implements. Then, after having secured for Melbourne a perfect set, properly classified and accurately described, the duplicates could be exchanged with Museums in other parts of the world for weapons of other native races. If this work were undertaken, it would certainly be a very good thing to have the weapons which Mr. Jennings so kindly proposed to obtain. He thought, however, that the place for them should be more public than the Royal Society's Hall. Their proper resting place would be the Public Library. There were a good number of weapons there already, but so far as he knew, they had not been classified or examined by experts. If that collection could be completed, and the genuineness of the articles guaranteed, and the circumstances under which they were employed be accurately determined, it would be a very good work. Side by side with this, they could have specimens of weapons from other parts of the world, and the collection would become of very great value indeed. A complete and authentic collection of that sort for Melbourne was one of the great objects of this Section, and if Mr. Jennings could succeed in obtaining the weapons he had mentioned from India, they would be most thankfully received.

Dr. NEILD said that thirty years ago there had been an attempt on the part of the Society to make a collection of various curiosities, and it had not been found convenient to keep them, as they required more attention than it was in the Society's power to give. He would therefore suggest that the collection should be kept in the Public Library, or in the University. Professor McCoy took a great interest in the subject, and would no doubt be able to care for them.

Mr. WHITE remarked that Professor Mill, of Japan, when over here, wished to make a collection of native weapons. He went into rather a noted place, and said he wanted some native weapons, and he was asked whether he wanted

genuine or German ones. He inquired if they kept both. "Yes!" was the reply, "but the German ones are much cheaper than the others." He hoped that the manufacture of these sham weapons would be stopped.

Librarian's Report.

Dr. Neild, the Librarian, said that the substance of his Report had been published in the circular. The Library was making fair progress, and he was having the serials bound, and missing parts added, so as to make it as complete as possible. A catalogue had been compiled, which during the year would be printed and circulated among the members. He thought it would be a very peculiar production, as, in his opinion, a more curious Library in the way of variety and eccentricity did not exist. He supposed that 90 per cent. of the books of the Library were presentations. During the past year the shelving of the Library had been added to, and he thought in the coming year they would require still more. On the whole, considering the difficulties they had had to encounter, and the peculiar circumstances under which the Library had been formed, he thought their collection was really a unique one, and he was proud of having had the honour of being Librarian for the past twenty-five years.

The Reservation of Wilson's Promontory.

The President stated that he had received a letter from a gentleman interested in the question of the reservation of Wilson's Promontory as a National Park. It would be remembered that the subject was before the Society some time ago, and there had been considerable discussion, and a resolution had been passed in favour of the reservation. He believed it was proposed at the present time to subdivide and sell portion of the Promontory. He did not know how far the proposal had gone, or whether the members thought the matter was one that should be further pursued.

Professor Spencer said that eighteen months ago the Field Naturalists' Club had taken the lead in getting up a deputation to the Minister of Lands, requesting him to make a reservation of the Promontory, but until the other day there had apparently been no result. Within the last

month, a notice had appeared in the *Argus*, stating that the Minister approved of the recommendation of the Field Naturalists' Club. Then there had appeared another notice, stating that the Minister had decided to reserve part of the Promontory for the purpose of laying out a township. Mr. Gregory had brought the subject before the Field Naturalists' Club at its last meeting, and it had then been decided that the Secretary should endeavour to ascertain the meaning of these contradictory statements; and if it were found, as seemed likely to be the case, that it was intended to reserve part of the Promontory for the laying out of a township, a deputation would be formed to wait upon the Minister of Lands, and the Royal Society was to be asked to nominate the members of the old deputation to serve again. He would propose that these gentlemen should be empowered to act, as possibly before the next meeting they would be under the necessity of waiting upon the Minister of Lands.

Mr. WHITE moved, "That the old members be again appointed to serve on a deputation to protest against the establishment of a proposed township." If once a township were established, then good-bye to a permanent reservation.

Mr. JENNINGS seconded the motion, which was put, and carried.

The PRESIDENT remarked that the argument in favour of the reservation was—that Wilson's Promontory was practically an island, was naturally isolated, and was a piece of country of varying character, with a very great range of elevations from the sea level to more than two thousand feet above it. It was surrounded by the sea except at one point, where it was connected with the mainland by a strip or sandy barren country, across which native animals would be very unlikely to travel. It was practically an island, and were a township erected, its integrity would be destroyed, and its insular position would be at once lost.

The following paper was read, "The Oology of Western Australia," by A. J. Campbell.

Professor SPENCER moved, "That Mr. Campbell be asked to read his paper," Mr. Campbell not being a member of the Society."

Mr. White seconded the motion, which was put, and carried.

At the conclusion of the paper, some specimens were exhibited, and photographs circulated.

The President said that such a paper could hardly give rise to much discussion, seeing that it was simply a record of facts. At the same time the record of such facts was an exceedingly valuable piece of work. It was one of the first duties of a Society, such as theirs, to encourage the accumulation of such papers, and to preserve the results of such investigations in its publications. He trusted that such work would be vigorously practised by their Biological Members. It was one of the most important branches of the work of the Society, and one that tended to bring the Society credit in other parts of the world.

Mr. Jennings said he thought it would be interesting to know whether the birds were only to be found on the island referred to, and in that case, whether there were any peculiarities in their habits, and in the character of the country to explain why they were only found in that part of the country.

Professor Spencer said they were very grateful to Mr. Campbell for giving them the result of his work, as hitherto very little had been done in that direction. With regard to the nocturnal petrel, which he believed was the only one known, he would like to know if Mr. Campbell had discovered any reason for this bird taking on its nocturnal habits, and whether there was one in South Australia.

Mr. Campbell, in reply to Professor Spencer, stated that he had not found any reason why the bird should be nocturnal. As Professor Spencer said it had not been recorded before, he had been very much astonished on finding this to be the case. Referring to the mutton bird, he said he thought there was no instance of any petrel breeding on the mainland. They did so on the rocks sometimes, within two hundred yards of it. Possibly they were crowded out, as the place was honey-combed all over. In reply to a question by Mr. White, he stated that he had not noticed any rats on Rocknest Island. He believed Abrolhos Island was swarming with them at one time, but they were common European rats introduced by some shipwreck. The rainfall on the Guano Island, was about

eighteen to twenty inches in the winter time. The Guano is worked in the dry season, between October and May.

Mr. McAlpine wished to know whether the birds were timid or bold on the island. Also, in reference to the colours, he would like to know if the colour of the nests always corresponded with the colour of the tree in which it was found, and whether the bird always confined itself to certain trees.

Mr. Campbell, with regard to the fearlessness of the birds, stated that whilst arranging the plates for the photographs, one bird perched on his camera, and another took the liberty of perching on his head; and in placing the camera, he had to use sticks to get them out of the way. With regard to the nests being built only in certain trees, he did not think that was the case. The hakea bush was very thick, and in all probability the bird that built in the hakea bush would build in any other thick bush.

Mr. Rusden gave notice that at the next meeting he would move the appointment of a Committee to inquire into the available evidence on the subject of Cremation.

Thursday, May 8th.

The President in the chair.

The minutes of the previous meeting were read and confirmed.

The Rev. E. H. Sugden, B.A., Master of Queen's College, signed the Roll, and was introduced to the Members.

Six gentlemen were nominated as Members, and five as Associates.

Mr. Ludovico Hart was balloted for, and announced to be duly elected as a Member.

The President informed the Members of the decease of Mr. Reed, who, he said, had taken a great interest in the Society, and acted as its Architect gratuitously from its inception. He had left many monuments behind him, besides the Royal Society's Hall, as records of his skill and taste. The Society was greatly indebted to him for his professional assistance, which had always been given freely and ungrudgingly.

Dr. Neild reported the receipt since the last Meeting of 478 publications.

Dr. NEILD also announced the receipt of a notice served upon the Society through the Caretaker, by the Inspector of Streets, to the effect that the trees growing round the grounds were encroaching too much upon the footpath. He stated he had ascertained that in no instance were the branches of the trees less than ten feet above the ground, and were not likely therefore to be a source of inconvenience to passers by. The complaint that they obstructed the light was nonsensical. Even if they did, nobody would suffer but the Society. He thought this was an unwarranted interference with the beauty of their grounds, and he would therefore call a Meeting of the House Committee who would investigate and report upon the matter.

CREMATION.

Mr. H. K. RUSDEN, in accordance with notice given at the previous Meeting, moved the appointment of a Committee of experts to enquire into this subject. He said:—It may perhaps be too much to expect you to remember that I had the honour of reading a short paper before the Hygienic Section of the Australasian Association for the Advancement of Science, on the subject of "Cremation, a Sanitary Necessity." I had collected a few papers and books on the subject, and thought it a pity that the occasion should pass without a paper on it. Shortly before the Meeting of the Association I ascertained that none had been offered on Cremation, so I undertook to produce one. In examining my materials, I was even more struck by the important evidence of the imminent danger to the public health involved in the present system of burial, and of the shocking and general desecration of the sepulchres of our dead nearly everywhere, than by the rapid progress now being made by Cremation. My paper was, in fact, devoted to the condensing of that evidence, to the neglect of equally interesting information as to the various methods in use in different parts of the world for effecting Cremation. I had long been aware of the superiority of Cremation as a means of disposing of the dead; in fact, I read a paper to the Health Society 14 years ago, advocating that among other measures of funeral reform. I have for some time also intended to take advantage of the first favourable opportunity of bringing it prominently under public notice. I think that time has come, and that the adoption of Cremation in

Melbourne now would not only be a wise sanitary precaution, but also a most important economical measure likewise. My particular object in raising the point to-night is to move according to notice that a Committee of experts be appointed to examine the evidence which I am in a position to produce, and more which I expect from England, and to report whether Cremation is not a real sanitary necessity; the best known means of putting an effective stop to the shocking but otherwise unavoidable desecration of sepulchres wherever there is a rapidly increasing population; and whether it would not be also an immense economy besides. I take it that any system would be unsatisfactory and inadmissible which did not provide all practicable satisfaction to reverential feelings. Attached to the Crematory therefore should be a commodious chapel or temple, in which memorial services could be held at any time. The Committee might also report upon the evidence produced of the complete and unavoidable failure of burial to satisfy reverential feelings in present circumstances wherever population increases as fast as it does in England, America, and Australia, and not only on the points raised in my paper, but also on the best mode of carrying into effect the objects in view. The verdict of such a Committee could not but have an important and useful effect upon public opinion on the scientific and other aspects of the question. The present juncture, when the town and suburban cemeteries have proved clearly inadequate to the purpose for which they were reserved, and when the only other alternative suggested, is the providing of another twenty-six miles away, seems particularly appropriate for recommending the substitution of Cremation. The distance of the Frankston cemetery must involve an oppressively increased expenditure to most persons in the community. I beg leave to move that a Committee be appointed to consist of Professor Masson, Professor Kernot and the mover, to examine and report to this Society upon the evidence of the failure of burial, and the best system to substitute for it.

Dr. NEILD, in seconding the motion, said he thought Mr. Rusden's proposition would in no way interfere with the convictions of those who objected to Cremation. It was very desirable that they should have a report upon the whole subject.

The PRESIDENT, in putting the motion, said he thought this was a matter of importance. It was, however, com-

paratively harmless from this point of view, that it did not commit anyone to any particular view.

The motion was carried unanimously.

Mr. LUCAS then read a paper entitled "Fishes new to Victoria not hitherto described."

The PRESIDENT said it was satisfactory to see the Biological Exploration of Port Phillip progressing, new specimens being obtained and new species named.

Mr. MCALPINE, referring to the peculiar marks by which the sexes could be distinguished in the species described by Mr. Lucas, said that this was an exception to the general rule. It would have been of great service to him had he been able to distinguish between the sexes of the cod when he had been engaged in freezing it, but the fishermen had been unable to give him any information on the subject. He thought it very desirable that, in the case of the food fish, some means of distinguishing the sexes should be discovered.

Mr. LUCAS, in reply, said that he believed there were no distinguishing marks on the commonplace food fish, but in the case of a few other species with coloured fins, a distinction could sometimes be made.

Professor SPENCER read a paper entitled "The Nomenclature of Chicken Embryos." At its conclusion, some lithographed illustrations were passed round.

The PRESIDENT said he thought Professor Spencer's suggestions very reasonable.

Mr. MCALPINE said he thought the proposal an excellent one, and would be a very desirable innovation from a student's point of view. Under the old hours system, great difficulty was experienced in determining the stage at which the embryo had arrived.

Mr. DENDY then read a paper "On the Victorian Land Planarians."

The PRESIDENT remarked that Mr. Dendy had followed up this subject with great vigour and perseverance.

Mr. HOGG said that Mr. Dendy's paper was so exhaustive that little could be added. He had lived in a place where planarians were very numerous and had been able to see

what Mr. Dendy had also noticed—that at certain times they were very scarce, but after a little rain would become very plentiful. At first, he had been very doubtful as to whether their different markings should be taken as indicating different species. Having found five or six different kinds huddled together under one log, he had been disposed to think that the varied colours were indications of different stages in growth. But from later researches, undertaken in company with Mr. Dendy, he had found that the lines were very well marked and distinct, and therefore Mr. Dendy had very properly decided to class those of different markings as of different species. He was glad that Mr. Dendy had been able to record so much during the short time he had had at his disposal.

Professor SPENCER said they were very much indebted to Mr. Dendy for having settled the point as to whether the difference in colour-markings could be taken as indications of difference in species. Another point raised was, as to whether the colouring was protective. He thought the only planarians he had seen in the open air were the most brightly-coloured ones, which would seem to favour that theory.

Mr. DENDY said he had very rarely seen a dull-coloured planarian out in the day time. Those most brightly-coloured were seen most frequently.

A MEMBER said that sometimes the colour was changed by the food upon which they fed. His gardener had pointed out to him an animal preying upon some of his flowers, and he had remarked that it changed its colour according to the plant upon which it was feeding.

Mr. DENDY said that even though it varied in the colour, the pattern remained unchanged. The tints of the stripes sometimes varied to a considerable extent.

Mr. LUCAS asked if Mr. Dendy had noticed any difference in shape between those planarians that remained under stones and logs, and those that went abroad. It seemed to him that those he had never met with abroad were comparatively flat, which would seem natural enough.

Mr. DENDY said that Mr. Lucas was quite correct. Those that ventured abroad were rounder in form. The first land planarian ever described was described by Darwin.

Thursday, June 12th.

The President (Professor KERNOT) in the chair.

The minutes of the last Ordinary Meeting were read and confirmed.

The PRESIDENT announced that the following gentlemen were nominated as members and associates :—Members—Messrs. H. R. Hogg and Thos. Lambert. Associates—Messrs. R. T. Elliott, Thos. Craig, and H. Grayson.

The PRESIDENT, in the absence of the Hon. Librarian, Dr. Neild, reported that 185 publications had been received from various parts of the world, 129 of which were printed documents and 26 maps.

Mr. Way and Professor Lyle having been nominated by the Council for the two vacant seats on the Council, were declared duly elected.

The following ladies and gentlemen were balloted for and declared to be duly elected :—Members—Pietro Barracchi, Rev. J. Mathew, Dr. Ambrose Wilson, Dr. Alex. Leeper, Dr. J. W. Springthorpe. Country Member—T. S. Hall. Associates—W. H. A. Pye, T. H. Hart, M.A., B. Sc., Miss L. M. Blair, Miss L. F. Blair.

The PRESIDENT, in announcing the result of the ballot, remarked that this great accession to their number was gratifying, not only to the Treasurer, who received the subscriptions, but to the Members generally, as it was an indication of the growing popularity of their Society. A great number had joined their ranks because of the attractive meetings of the Literature and Fine Arts Section, which had proved a very great success, but still many of those just elected were interested in severer studies.

Professor ORME MASSON read a preliminary note on "The Physical Properties of Ethides considered in reference to the Periodic Law of the Elements."

A discussion ensued, in which the President, Professor Lyle, Messrs. Kirkland and Marks took part.

Mr. DENDY read a "Note from the Biological Laboratory of the University of Melbourne, on the Presence of Corpuscles in the Liquid discharged from the Apertures of the Nephridia and Oral Papillæ of Peripatus."

A discussion ensued, in which the President and Professor Spencer took part.

Mr. McAlpine then read a paper entitled, "Investigations connected with the Copper-head Snake (*Hoplocephalus superbus*, Günth.), and its Parasites"—

(*a*) Observations on the movements of the heart in and out of the body.

(*b*) Remarks on a fluke parasitic in the body.

(*c*) On a nematode found in the stomach.

At the conclusion of section *a* of Mr. McAlpine's paper,

Professor Spencer said he thought the movement of the excised heart along the plate was due to muscular contraction, and explained on the blackboard how this might be possible.

A discussion then followed on the definition of the word death, as used by Mr. McAlpine, in which the President, Mr. Marks, Mr. Dendy, and Professor Spencer took part.

Thursday, July 10th.

The President (Professor Kernot) in the chair, and 32 Members and Associates present.

The minutes of the last General Meeting were read and confirmed.

Mr. P. D. Phillips and Mr. George Gordon McCrae were nominated as Associates.

Mr. H. R. Hogg was elected a Member, and Messrs. H. Grayson, Robert Craig, Thos. Lambert, and R. T. Elliott, M.A., were elected Associates.

Mr. Ludovico Hart signed the Roll, and was introduced to the Meeting.

In the absence of Dr. Neild (the Hon. Librarian), the President announced that, since the last Meeting, 80 publications had been received from various parts of the world.

Mr. A. W. Howitt read a paper on "The Eucalypts of Gippsland."

The President said that they must all bear witness to the completeness of Mr. Howitt's work. The paper just read

represented the accumulation of the observations of many years, and he had listened to considerable portions of it with very great interest. He thought it might be interesting to know what eucalypts grew highest on the mountains. He recollected camping a good many years ago on Mount Hotham, at an altitude of about 5700 feet above the sea level. The camping party had tried to utilise the eucalypt found there for tent poles, but as they only grew to a height of 15 feet, this was found to be a matter of impossibility. On the northern slope of Mount Feathertop, at an altitude of about 5500 to 6000 feet above the sea, he found some eucalypts only about 5 feet in height, and presumed these were one of the forms referred to. With reference to the height of eucalypts, after a number of actual measurements, he was of opinion that the popular height should be reduced 30 per cent. He himself had only come across one tree which was 300 feet in height. Some time since there had been great talk of a tree having measured 460 feet. Actual measurement, however, proved that it was only 219 feet 10 inches, or considerably less than half the height with which it had been credited. He was very sceptical, indeed, as to anything over 300 feet. Having been told of a forest where specially large trees had existed, after a series of measurements, he had not found one over 260 feet, and not many over 200 feet. The re-foresting of parts of Gippsland was a very interesting fact, and one he confessed he had never heard or dreamt of before. The general impression was, that the country had been denuded of its forests, and that by reason of its denudation, the floods and droughts were being rendered more severe. It appeared, however, that there was an opposite action going on, and it would be very interesting to watch and note, if possible, the effect of this upon the rainfall. The red-gum trees about Melbourne, such as those in Royal Park, were in many cases dying very rapidly, and he would like to know whether this was the natural decay of nature, or whether it had been accelerated by other natural causes. One of the curious phenomena noticeable in the dense forests of Victoria was the belts of dead trees found in certain places. On some high mountains, there were areas which looked as though they had been cleared, but where this could not possibly have been caused by the hand of man. Near the head of the Yarra, some years ago, he had come across a tract of country which was characterised by this peculiarity. It was one mass of fallen timber. The original

forest seemed to have died and fallen, and a young forest was springing up through it. This commenced rather abruptly, and extended for miles, when it ceased abruptly also. He would be glad to know if Mr. Howitt could give any explanation of such a phenomenon occurring in an utterly uninhabited district, where probably human foot had not trodden more than once or twice in the history of the country. Mr. Howitt's paper was a most valuable and interesting one.

Baron von Mueller concurred in the commendatory terms in which the President had spoken of this paper, which represented the result of observations which must have extended over a long series of years. Indeed, Mr. Howitt's observations had been so thorough that nothing seemed to have escaped him, not even the smallest forms of vegetable life. The Eucalyptus amygdalina, referred to by Mr. Howitt, had been noticed by the scientist who accompanied La Perouse on his first expedition. He was very much beholden to Mr. Howitt for the honor he had conferred upon him, of naming the new species of eucalypt he had discovered, after him. This was a eucalypt of great commercial value, and that it should bear his name was an honor of which he felt proud. Forty years ago he had commenced to study the eucalypts in the Botanical Gardens, and had been very much struck with the resemblance of the odour of the oil to that produced by a certain tree, having great medicinal properties, in India. From that time the study of the eucalypts had become very interesting to him. Mr. Bosisto had done great good in drawing attention to the eucalyptus oil question, and rendering it a great industry here. Mr. Howitt's paper was one of the most sterling contributions to the records of the Society, and his discovery, which had been brought out at that meeting, of a new and valuable timber, was one of very great importance. His endeavour to bring geographical knowledge to bear on the distribution of the trees was a work in an entirely new direction, and he had, in reality, for the first time by his tables and diagrams, succeeded in showing in a geographical manner the distribution of the trees, which could only be done after a great many observations, extending over a long series of years. Indeed, the work of the next century would be to carefully map out the distribution of the original vegetation in the various parts of the globe. In reality, this work had only just been commenced in Europe, and Mr. Howitt

was the first gentleman in this colony who had laboured in that direction. With reference to the height of trees, Mr. Howitt himself was a reliable authority, and had given the height of one tree at 415 feet. Over-statements had been made, but it should be remembered that it was not always possible to verify these statements. The first great error in over reckoning was made by Mr. Clyne, who had given the height of a eucalypt at 480 feet. He did not think that that gentleman had intended to make a mis-statement, but that it was an error of memory, and the height really was 380 feet. There was no doubt that the largest eucalypts were no longer in existence. Observations that he had himself made clearly proved the existence of trees a good deal over 200 feet in height, and he did not think it an exaggeration to say that eucalypts sometimes grew to the height of nearly 400 feet. Authors could not be responsible for the reports given in their writings, when the authority from whence they were obtained was quoted. It should also be remembered that it was not always easy to get a good base line for observations, and that it was much more difficult to measure our straggling eucalypts than the straight upright Californian pines. Another question of interest was the dispute going on in Europe, as to the value of eucalyptus honey. The question had arisen—Whether eucalyptus honey, containing to some extent eucalyptus oil, could be used for medicinal purposes? The honey was somewhat different to the honey made by domestic bees, and it was supposed that it was deposited in the hollow trees by native bees, or swarms of domestic bees which had gone astray. This honey did not readily become opaque, and might possibly be utilised as he had indicated. Finally, he congratulated Mr. Howitt on the success which had attended his long scientific investigations, and as he seemed as hale and hearty as ever, he hoped he might live a long time into the next century to carry these observations out.

Mr. WHITE said he was very glad indeed that the question of the height of the eucalypts had been mentioned. A few months ago, during the last Exhibition, these big trees had been dismissed in a shower of ridicule, as ghosts. He quite agreed with the Baron, that these trees might have existed. One of the largest ever referred to was given on his authority, as having been measured by one of his assistants with a tape line, and found to be over 400 feet. He would like to have the Baron's statement as to that tree. It was said that

Australia had been deposed from the position she once held in this respect, but if that measurement could be trusted, he did not see why she should not be re-instated.

Baron von Mueller, in reply, said he had not had an opportunity himself of obtaining any of the very large measurements that stood on record, and he thought that Mr. Howitt was in the best position to answer Mr. White's question, because he had given them information about a tree, which was stated from very reliable sources to be 415 feet high. In many instances the trees, the heights of which had been recorded, were fallen to the ground, and the measurement thereof must have been correct. In the early years, very little notice had been taken of the heights of the trees. Trunks of immense length had been utilised in the crossings of rivers and brooks, without the trouble to ascertain their length being taken. As the population became larger, the largest trees had disappeared, and he did not think it therefore very extraordinary to assume that eucalypts attained 400 feet.

A Member said, with reference to the dead forest mentioned by Mr. Howitt, that he and his brother had come across one when travelling many years ago through the Gippsland District, between Port Albert and Sale. It was many miles in extent, and they had been very much impressed by the strange sight, never having before in their travels seen anything like it. When they camped at night, their surroundings presented a most weird appearance, the great white limbs of the trees reflecting the flames of their camp fires at a great distance all round. They could scarcely sleep at night for the noise of falling timber. They had been very much exercised in mind as to the cause of this, and he was very pleased to find reference made to it in Mr. Howitt's paper. Various explanations had been given, but this seemed a better explanation than any he had hitherto heard.

Mr. Howitt said that, as to the height of the trees, so far as his own measurements were concerned, the most reliable was that of a fallen eucalypt, which, as it lay on the ground, measured 350 feet. The height of 415 feet, mentioned by the Baron as having been given by him, was given to him by several persons whom he considered reliable authorities. The owner of a saw mill at the place where it grew, told him that that was its height.

Mr. WHITE.—Was the tree cut down and measured directly ?

Mr. HOWITT said that he understood it had been cut down and measured, but he had no means of checking the measurements. The highest tree he had personally measured, was one 350 feet in height, as he had before stated. The increase of floods was supposed to be caused by the diminution of timber, but he was inclined to think that they were to be accounted for by the hardening of the country generally, and more especially by the increased drainage which resulted from the making of roads and tracks. The water ran off the country far more rapidly than it had previously done, and even assuming that there was no difference in the rainfall, he would expect the floods to come down with far greater rapidity than was formerly the case. The cutting power of the Snowy River for instance, was very great, and he doubted whether there were 10 acres of soil left in the valley up to the high water mark. In many cases the sides of the valley were completely stripped to the rock, and so far as he knew, there was not a tree standing within the flood marks in that valley. This was due to the suddenness and rapidity with which the floods came down from the table land, such as the Gundai flood which occurred in 1849 or 1850. Similarly, he had noticed in the Omeo District that several gullies had been cut out. This all helped to increase the drainage.

Thursday, August 14th.

The President (Professor KERNOT) in the chair.

The minutes of the last meeting were read and confirmed.

Sidney Plowman, F.R.C.S., J. Talbot Brett, M.R.C.S., G. A. Syme, M.B., F.R.C.S., were nominated as Members; and Lenthal Oldfield, Edward E. Rosenblum, M.B., and H. Best, were nominated as Associates.

Messrs. P. D. Phillips and George Gordon McCrae were elected as Associates.

The PRESIDENT, in the absence of Dr. Neild, the Hon. Librarian, who was unable to be present, read the Librarian's Report, which showed that 130 new volumes had been added to the Library during the past month.

Professor MASSON read a paper on "The Relations of Molecular Volumes and Boiling Points."

A discussion ensued, in which Messrs. Jackson, Love, and Professor Masson took part.

ANTARCTIC EXPLORATION.

The PRESIDENT, referring to the progress made, said that this matter appeared to have entered into a new phase. He said there was a definite offer from Barons Nordenskiöld and Oscar Dickson. Those gentlemen were willing to send a Swedish ship to the Antarctic regions, provided that Australia contributed £5000. The expedition would not be a whaling and scientific one, which all experts condemned, seeing that the two objects would be in conflict. It was proposed to despatch a purely scientific expedition. The offer had been before the Antarctic Committee, at which the following resolution was unanimously passed:—"This Committee learns with pleasure the munificent offer of Barons Nordenskiöld and Oscar Dickson, to defray half the cost of an expedition to the South Polar regions, Australia contributing (£5000) five thousand pounds. It cordially desires to accept the proposal, resolving to appeal at once to the general public throughout the Australian colonies for subscriptions for the purpose."

Several gentlemen had offered to head a subscription list for the purpose of raising the £5000 to be contributed by Australia towards the enterprise. Subscription lists would be shortly issued, and it was hoped that the appeal would be cordially responded to. The time for the despatch of the expedition would be the summer of the year 1891. The Committee had arranged that Mr. Griffiths should lecture on Antarctic Exploration before the Bankers' Institute. The printed paper issued to Members, gave very full information on the matter.

Professor SPENCER moved the Resolution No. 1 on the paper in the hands of Members.

Mr. H. K. RUSDEN seconded the motion.

Mr. GRIFFITHS, in supporting the Resolution, said he had had a talk with the Secretary of the Royal Geographical Society, and learnt that Mr. Gunderson had been in communication with the Minister for Foreign Affairs in

Sweden, and through that Minister, with Barons Nordenskiöld and Oscar Dickson. It was through that channel that the offer had come. Owing to a delay, which was not altogether avoidable, the matter had stood over a little longer than it should have done. It was now desirable to communicate with those gentlemen, and to acquaint them with the fact that we in Australia were now starting in earnest to raise the sum of £5000. He suggested that Mr. Gunderson should be authorised to telegraph to the Minister in Sweden, informing him that it was expected that the sum would be shortly raised, and asking if the Barons were still willing to proceed. If a reply could be received in time to be read at the meeting, it would be of assistance. The Geographical Society was willing to bear half the cost of the telegram, and it was hoped that the Royal Society would bear the other half.

Professor SPENCER asked to be allowed to substitute the following resolution for the one already proposed:—"This Society learns with pleasure the munificent offer of Barons Nordenskiöld and Oscar Dickson, to defray half the cost of an expedition to the South Polar regions, Australia contributing £5000. It rejoices to see that the proposal has been accepted, and resolves to support the Antarctic Committee in its appeal to the general public throughout the Australasian colonies for subscriptions for the purpose."

Mr. RUSDEN agreed to the Resolution as altered, and on being put to the meeting, it was carried unanimously.

Mr. RUSDEN said that Mr. Macdonald had shown him a telegram from the Royal Society of New South Wales, and one from Adelaide, promising support to the movement.

On the motion of Mr. RUSDEN, seconded by Mr. GRIFFITHS, it was resolved that a report from New Zealand, on "The Whales of the Southern Ocean," should be taken as read, and be ordered to be printed.

The PRESIDENT announced that the New Zealand Government had made a grant of £500 to aid the Australasian Association, and that Government would also do the printing for this year without charge.

Mr. G. S. GRIFFITHS, F.G.S., read a paper on "The Marine Sedimentary Beds underlying Warrnambool."

the "gault" of Great Britain, but of course, its age was entirely different. The term "green sand" had been applied by Professor Hutton to tertiary rocks in New Zealand. He did not use the terms as indicating the age of the rocks, but simply their mineral character. Professor Prestwich's text-book on geology, treated the subject of the admission of sea water to the land, and he expressed without any doubt the opinion, that under such circumstances as those described in the paper, the sea water did not percolate inland at all, but was absolutely excluded from the strata by the presence of fresh water in the beds.

Thursday, September 11th.

The President in the chair.

The minutes of the proceedings of the previous meeting were read and confirmed.

The following were nominated for election:—Members—C. N. Hake, C. G. W. Officer. Associates—N. T. M. Wilsmore, Elderson Smith, Mrs. Elderson Smith.

The following gentlemen were balloted for and declared to be duly elected:—J. Talbot Brett, M.D., G. A. Syme, M.B., Lenthal Oldfield, F.R.C.S., as members, and Heinrich Best and E. C. Rosenblum, M.B., as associates.

The Hon. Librarian reported that, since the last meeting, 77 publications had been received from various parts of the world. A number of volumes had been bound, the Council with its customary liberality having voted £40 for that purpose. A catalogue had been prepared, which would afford great assistance to those wishing to consult the library, and after going through it, he would put it on the table.

Professor Orme Masson read a postcript to the paper last read by him.

Mr. Marks said that the papers read by Professor Masson could not be adequately appreciated until printed and published, as they required an amount of study before the value of the results obtained could be apparent.

A Note on the Shell-bearing Mollusca obtained in the Port Phillip Biological Survey, by Professor Ralph Tate, of

Adelaide, was read by Professor Spencer in the absence of Mr. Lucas, to whom, as Secretary of the Committee, it had been sent.

A number of specimens had been forwarded to Professor Tate by Mr. Lucas, and this note had been received from the Professor, naming a portion of them.

Mr. DENNANT remarked that a curious fact with regard to Victorian shells was, that many of them had first been known in their fossil form before the living shells had been obtained. The importance of the work of searching for shells which was carried on by the Survey Committee could not be over estimated. If the living specimens had not been obtained, the fossils might have been thought to be those of extinct species, and a deposit which might otherwise be defined as miocene would perhaps be proved by the living shell to be pliocene. The Society was to be congratulated on the work that was being done.

The PRESIDENT said that the members would be very glad to know how the Survey was progressing; what was being done, and how much more was to be done; and whether the results were up to expectations. The Survey was started some three or four years ago with some enthusiasm, and although little had been heard of it lately, he believed the work was being carried on steadily and well by those interested in it. Still, the rest of the members were in ignorance of what was being done.

Professor SPENCER said that the Committee had been established about two years, during which time a certain amount of work had been done. A little dredging had been done in the immediate neighbourhood, but the greater proportion of the work had been done by Mr. Bracebridge Wilson, who spent the whole of the summer in dredging. Most of the dredging had been done close to and outside the Heads. When dredging in the still deeper water had been attempted, probably, more interesting specimens would be obtained. At the same time, a very large collection had been made, which had been divided into different groups and sent to specialists, as Dr. Herbert Carpenter and Mr. Jeffrey Bell. The sponges were in the hands of Mr. Dendy, who was spending a great amount of time on them, and intended shortly to bring out a general work on the subject which would be of great value. He was doing anatomical work, which took much more time than the

naming of the species, and if any of the Members cared to go to the University and see the collection, the magnitude of the work would be better understood. Before the sponges were named, two or three years at least must pass by. The specimens of Polychæte worms, had been sent home to Mr. Cunningham, at the Marine Biological Station, Plymouth, who was one of the best workers in that subject. Another group—the Tunicata—had been sent home to Professor Herdman, of Liverpool, who was at work on them, together with a large group of the same forms sent from Sydney. Others had been sent to different workers, and preliminary reports had been obtained. Professor Hatchett Jackson was at present working at a Report on the Pycnogonidæ, which would be illustrated and published in the Society's "Transactions." All the fishes had been named by Mr. Lucas himself. He thought as much work had been done in two years as could have been expected. In a year or two's time a great deal more in the way of results might be shown, as then their reports would be coming in. Mr. Bracebridge Wilson was still dredging; he had collected most of the animals he was likely to get easily and did not often come across new specimens, and those sent in were getting fewer in number, although, probably, more valuable. It might be some time before full reports would be able to be presented.

The PRESIDENT said they were glad to hear that matters were progressing satisfactorily; at the same time, it appeared that the work was only being done in the vicinity of Sorrento, and when it was considered that Port Phillip was something like 200 miles in circumference, with coasts of a very varied character, it was to be hoped that the other parts would receive attention in due course, although it was difficult to see exactly how it was to be done. For instance, was anything interesting likely to be discovered along the coast from Williamstown to Geelong.

Professor SPENCER said that Mr. Wilson made Sorrento his headquarters during the summer, and consequently, very little dredging had been done in the immediate neighbourhood of Hobson's Bay. He thought that the part of the Bay that had been done was likely to repay the best.

Mr. DENDY said that more dredging was not what was wanted. Mr. Wilson swamped them with material. He had received something like 1500 glass jars filled with sponges, and he could not properly work out one species in

one week, whilst the preliminary work of sorting occupied many months. The making of each preparation involved a considerable amount of labour. What was wanted was more labourers, not more exploration. Mr. Gabriel had done a lot of work in exploring other parts of the coast. A little work had also been done on the north of the Bay. The Field Naturalist and University Science Clubs had made excursions and brought back many valuable specimens.

The PRESIDENT said it seemed as though the work were going on outside the original scope of the survey.

Mr. WAY thought it was always contemplated that the interior of Port Phillip should receive first attention, and that the Survey should afterwards be extended round the coast.

Mr. DENNANT said that when the shells in Victorian waters were originally named, a number was obtained merely as dead shells in the absence of living ones, and it afterwards transpired that many of them did not belong to Victorian waters at all, but had been brought from other parts of the world as ballast, and a good many had to be excised. He took it that the Biological Survey was obtaining living specimens, and as far as the mollusca were concerned, the value of the work must be very great. A long list of the shells obtained in Portland Bay had been published, but he had no doubt that a number of them were exotics, owing to the number of ships from different parts of the world laden with ballast anchoring in that locality. This might be the case in Port Phillip. He would like to see dredging operations in Portland Bay and on the Gippsland coast. It was very noticeable that shells found in South Australian waters were not taken up in Victorian waters, and it would be rather interesting to know at what point they commenced to appear or disappear. A friend of his, when dredging on one occasion, had been astonished by getting a tremendous haul of shells, but he had afterwards found that, at that very spot, the ballast of a vessel had been thrown out. This was a source of error which needed to be guarded against, and the only safe way was to get the living shells.

A paper on the "New Britain Currency, or Shell Money," communicated by the Rev. R. H. Rickard, was read by Professor SPENCER, who said that this was the first paper

of a series which was being written by Mr. Rickard on the habits of the New Britains, and therefore Members might look forward to receiving more information shortly.

The PRESIDENT said this paper was unquestionably one that they would be very glad to have in the "Transactions," and he trusted that they would receive many more like it. With the spread of commerce, the old customs of the natives were being broken up, and while they continued to adhere to them, it was desirable that they should be accurately recorded.

On the subject of "The Sending of Pendulums from Kew Observatory to Victoria, for the Proposed Gravity Survey,"

Mr. ELLERY said Members would probably remember that some time ago Mr. Love had brought the question of a gravity survey prominently before them, and the probability of having such a survey then evidently depended upon the possibility of getting suitable apparatus wherewith to make it. Some twelve months ago, Mr. Love had read a paper with regard to the desirability of extending the pendulum observations (which had been taken in one or two points in Australia) more over the continent, and the matter was then discussed at some little length. The question then was, whether pendulum apparatus already in existence could be borrowed, or whether it would be desirable to get new apparatus. He had undertaken to communicate with the authorities at Kew and the head of the Indian Department in London, to see if he could get the pendulums which had been used in the great survey of India, and which he believed were lying unused at Kew. He had received a letter, stating that the pendulums had been finally swung at Greenwich and Kew, and were in such a condition that they could easily be transferred to the Observatory at Melbourne if there were any prospect of their being made use of. These pendulums had been used throughout the survey in India, and swung over nearly the whole extent of that survey. One of them had been brought out to Australia at the time of the last transit of Venus. Mr. Smith and Mr. Pritchard, of the American Coast Survey Department, were despatched to take observations in Australia and New Zealand, and swung one of the pendulums in Sydney. If a plan could now be devised, by which a survey could be carried out, there would be no difficulty in getting the pendulums. It was considered

very desirable and important that the pendulums should be swung in some of the central parts of Australia. He would undertake to get them out immediately if assured that there was some prospect of their being used for the purposes indicated. The best way, he thought, would be to form a sub-committee of the Royal Society, and to empower them to take the necessary steps. At last year's meeting, it had been stated that it was thought there would not be very much expense involved in the matter, so long as the instruments were obtained. Mr. Love had said he would be quite willing to go with the pendulums into the interior, or to any other place thought desirable, in order to swing them. At all events, it would involve some expenditure, and he thought the best way would be to appoint a sub-committee to consider the matter, and report thereon as soon as possible, so that the pendulums might be obtained in time to be used before the coming summer was over. He therefore moved, "That a sub-committee, consisting of Professors Kernot, Masson, Lyle, Mr. White, Mr. Love, and the mover, be appointed to discuss the matter, and to report thereon to the Society as soon as possible, Mr. Love acting as Secretary to the Committee."

This resolution was seconded by Mr. WAY, and carried unanimously.

The PRESIDENT suggested, in view of the approaching Antarctic Expedition, that there would be a possibility of getting the pendulums swung in some high Southern Latitude. Gravity experiments had been made in the Northern Hemisphere, but very few in the Southern Hemisphere, and he thought that a gravity determination in a high Southern Latitude would be a remarkably interesting addition to any physical information the Expedition could gather. Although the pendulums were by no means new, he presumed that they were sufficiently up to the times. He understood that it was the intention to swing them in vacuo. That was theoretically the best way, if it could be done satisfactorily. He did not know if that were generally done in the cases of other determinations. Perhaps Mr. Ellery would give them a little further information, especially as to the possibility of having a determination of the gravity in a high Southern Latitude.

Mr. ELLERY said, with regard to the swinging of the pendulums in vacuo, that that had been done in several places

in India, and the pendulums were now swung in vacuo at home. They were quite up to the modern form, being, in fact, the last pendulums that had been made. They were made on the most approved principles for the Indian Survey in 1876 or 1877. He did not think any pendulums had been made since, except one or two experimental ones in Germany. With regard to taking them down to the Southern regions, they could be easily carried if a place could be obtained to swing them in, and if an Expedition were carried out, it would be very desirable that one of the pendulums should go with it.

The PRESIDENT remarked that all the instruments needed for such gravity determinations would be a pendulum with all its subsidiary apparatus, a clock, and a transit instrument for regulating the clock.

Mr. ELLERY said it might be done with chronometers, but he did not think that the pendulum could be so well swung with the chronometer as with the clock. Of course it was a *sine quâ non* that to get good pendulum results, the observer must be well trained, and have had a lot of actual experience.

The PRESIDENT suggested that such experience could be obtained by one practising in Melbourne until thoroughly acquainted with the work. At how many places was it proposed to swing the pendulum?

Mr. ELLERY thought they should be swung in two or three places at least, and that in fact it would be hardly worth while getting them out unless they were swung in four places. There was no necessity to swing them in a great number of places.

The PRESIDENT: What about sea coast *versus* inland?

Mr. ELLERY said that, if experiments were made in that way, the observations might be multiplied. The most interesting experiment would be to repeat the observations formerly made in Melbourne and Sydney, and in the interior plains as distant from mountains as possible.

Mr. WHITE said the Overland Telegraph line would facilitate the matter. The exact time also could be conveyed along the line direct from the Observatory.

Professor MASSON wished to know where the money was to come from.

Mr. White supposed the Society would be asked for it, but thought the different Governments ought to contribute something.

The President said the first thing would be to arrive at the approximate cost of the survey, and to determine how many observations should be taken. It was suggested that there should be a certain degree of co-operation with the other Colonies. Would it be useful to extend the survey to Western Australia and New Zealand?

Mr. Ellery thought it would be useful if it could be done. The matter should be left in the hands of the Committee without any restrictions, so that they might submit a report and advise as to what should be done.

The President thought it desirable that the Committee should take an early opportunity of considering what should be done, how much it was likely to cost, and in what direction they could look for the money. If the cost were considerable and the stations numerous, he presumed they must look for some Government assistance.

Mr. Ellery said that before he would feel free in asking for the pendulums to be sent out, it would have to be decided that observations were to be made, and in one case at least, towards the centre of Australia. That would be a good excuse for getting them out.

The President thought that if they were used in Sydney, Melbourne, Adelaide, and the interior—Bourke had been suggested—that would be sufficient.

Thursday, October 9th.

The President in the Chair.

The minutes of the preceding meeting were read and confirmed.

The President stated that a communication had been received from the Geographical Society of Berne with reference to an International Congress of Geographical Science to take place at that city in August 1891, and inviting the sympathy and presence of the Members.

In the absence of Dr. Neild, the President read the report, which was to the effect that 171 publications had been received from various parts of the world.

Mr. DENNANT, F.G.S., then read a paper entitled "Notes on Miocene Strata at Jemmy's Point, with brief remarks upon the Older Tertiary at Bairnsdale," which he illustrated by a map of the district. At its conclusion,

Mr. GRIFFITHS said that the district which Mr. Dennant had visited and described was very interesting from a geological point of view, and was one of a large number of important districts which had been, practically, wholly neglected, owing to the fact that the Government of Victoria had been ill-advised enough to dismiss its Geological Staff some years since, in that way preventing the completion of the Geological Survey of Victoria, which, if it had proceeded on the lines laid down by Mr. Selwyn, would have been very far advanced to-day. It was very important that proper plans and sections should be prepared, as without them it would be impossible to complete the Geological Map of Victoria. While the Staff of the Government Geological Department was so short-handed, it would be impossible for the work to be proceeded with; and, under such circumstances, it was very fortunate that they had in the community a gentleman like Mr. Dennant, who had given special attention to the strata and horizon he had just described, and who therefore brought to bear upon his work a considerable amount of special knowledge which was of the utmost importance in dealing with such a district. Mr. Dennant's investigations of the strata of the Muddy Creek, and the coast as far as Mount Gambier, the results of which had from time to time been given to the Society, showed that he was a most competent observer in this particular department of the science; and he (Mr. Griffiths) was very glad indeed that, short as Mr. Dennant's visit had been, he had been able to gather so much data, of such a valuable and interesting character. When they heard that the fossils which he had been able to obtain from these localities presented a facies which was singularly similar, as far as some of the beds were concerned, to the celebrated Paris basin, and also to the beds of the Alabama district of America, they had an important addition to their geological knowledge; and the thought was suggested, that this was evidence of a development in life which bore a relationship to the development which was proceeding in Europe and America during the eocene and pliocene periods. It struck him that very important and interesting results might be obtained if, in addition to

collecting the fossils that were to be found cropping out of the side of the cliff on the southern side of the river, investigations could be made at greater depths, by means of wells or bores. They might thus get evidence of a sequence from, perhaps, as far down even as the jurassic beds. At any rate, they had secondary strata running through Gippsland, which cropped out to the south of the Drouin district, and disappeared as one proceeded eastward, under tertiary beds; and in a number of places, as at Bairnsdale, Port Albert and Sale, calcareous strata had been marked, some of which were in all probability of miocene age, the principal ones being, of course, pliocene; and these mesozoic beds possibly dipped right under the Gippsland Lakes, where they were concealed from view. If a bore were to be put down, and if they were fortunate enough to pass through fossiliferous strata, they might obtain a complete sequence from the mesozoic up to the miocene beds which Mr. Dennant had reported upon. It would be very interesting indeed, if they could have such a collection of the underlying strata made; but, while that was not likely to be done at present, it struck him that, by following up the creeks, it might be possible to obtain sections which would be of successively older age, for it would be easily understood that, in following up such a creek, they would at length reach a part where the tertiary beds would be found thinning out, and the upper silurian beds coming into view. It might be that beds which lay far below the water line, at one point approached the surface as they thinned out against the silurian outcrops; and by thus following up the creek, and examining the sections which it might present, they would easily obtain strata which could only be reached by sinking to a great depth in another locality. In this way, they might get evidence of beds very much older than the miocene beds reported upon by Mr. Dennant, and it would be very interesting to get evidence of their character. That all the beds in that locality were not on the same geological horizon, they had evidence from the different fauna obtained from the strata at Jemmy's Point on the one hand, and at Bairnsdale on the other. Mr. Dennant had determined the Bairnsdale beds to be of eocene age, and the Jemmy's Point beds to be of miocene age, so that here they had two distinctly different horizons within a short distance of each other; and seeing that the district had been very slightly explored geologically, a very slight attention to the

neighbourhood would probably yield evidence of other horizons. He thought they were under a heavy obligation to Mr. Dennant for having given attention to this district, and he had certainly added, in a material way, to their knowledge of the geology of Victoria.

The PRESIDENT said that one question suggested by the debate, was the question whether something might not be done in the way of urging the Government to re-commence the geological survey of the Colony on some complete system. In the old days there was a definite geological department, with Mr. Selwyn at the head, and a number of beautifully-finished geological maps had been brought out, covering parts of the Colony. They had from time to time, at rather irregular intervals, received occasional maps of isolated districts, but there did not seem to be anything like a uniform and comprehensive survey of the country in progress. Could not something be done in the way of agitating for such a survey? It was considered part of the duty of the Governments of most civilized countries to conduct such investigations, and in this country, where mining formed such an important factor in our progress, and contributed so largely to our revenues, one would have thought that geological surveying would be regarded as of sufficient importance to warrant a reasonable yearly expenditure. The geological survey under Mr. Selwyn had been given up at a time when the country was very much poorer than at present, and its revenues very much smaller, and in those days probably there had been economical reasons for the step taken; but now, when there was double the population, and double or triple the revenue that existed at the time of Mr. Selwyn's departure for Canada, it surely would not be a very large thing to ask that something should be done in the way of steadily and continuously following up the geological survey of the country on lines similar to those laid down by Mr. Selwyn.

MR. GRIFFITHS thought the suggestion a very excellent one, and if it were within the functions of the Society to move in the matter, steps should be taken to memorialise the Government. Very excellent work was being carried on by Mr. Reginald Murray and his assistants, but under existing circumstances, that gentleman could not possibly do any large amount of work; and he was quite sure that if the staff were re-organised and set to work, the benefits derived

by the country would a great deal more than cover the cost. He would be very pleased to do what he could if any endeavour were made to induce the Government to give some consideration to the matter, and suggested that it might be as well to form a committee.

The PRESIDENT thought this might be done. At any rate, it was a matter worthy of consideration.

Mr. GRIFFITHS thought it would be well to bring the matter forward at the next meeting of the Council, and to move the appointment of a sub-committee.

Mr. ROSALES said he was very glad to have heard the matter mentioned. A Royal Commission on Gold was now sitting, and he thought it very probable that if the matter were mentioned to them, they would take it in hand.

Mr. DENNANT was very glad that attention had been drawn to the matter. It had been his dream for many years to see this work again undertaken. He spoke of the difficulties experienced by individual geologists in their investigations without the aid of geological surveys, and stated that many inaccuracies existed in the maps which they did have, owing to the rapidity of the surveys made. Occasionally one of the members of Mr. Selwyn's old staff might happen to go over the ground, and a few corrections would appear in the next geological map, which would be published probably ten years afterwards, but really that was not the way to deal with a Colony like this. He certainly thought the Government should at once proceed to form a competent surveying staff, so that the Colony might be surveyed with the greatest possible despatch. Outcrops of valuable minerals and things of special scientific interest might be met with in different parts of the Colony, and yet such work was left to amateurs, who were generally too busy with their own affairs to be able to give much time to the examination of the strata of the Colony. Most of the goldfields, he believed, had been fairly well surveyed, but the major part of the country was left untouched. In many instances the geological work which had been done needed correction, and he really thought the Society would be doing good work if a sub-committee were formed to urge upon the Government the necessity of making a complete survey of the country. He had no doubt that in the mesozoic country there were numerous outcrops of coal which had not yet been met with; and if a complete survey were made of the

Gippsland country, as had been advised by Sir James Hector two years since, they would be able to determine with more accuracy whether those outcrops were likely to continue underground for any distance. A geological surveyor would be able to determine by the elevation whether two outcrops, say a mile distant from each other, belonged to a continuous bed, running perhaps beneath a neighbouring hill; whereas at present one person found one outcrop and another person another, and both reported their discoveries as totally different beds. An agitation by the Society would, he thought, have a great deal of weight with the Government, in inducing it to consider the propriety of re-establishing a survey of this country on a proper basis. Mr. Selwyn had done remarkably good work, and he supposed no better *resumé* had been written than that which appeared in the Exhibition Essays in 1886. Since then nothing had been done by the Government, and the whole thing had come to a sudden stop. If they were to go into the Public Library, and look at the work which had been done by Mr. Selwyn in Canada, they would be able to form some idea of what he might have done had he continued his labours in Victoria.

The PRESIDENT said that the matter should be discussed at the next meeting of the Council, and as there seemed to be a movement in the same direction elsewhere, it was to be hoped that ere long the surveying of the Colony would be proceeded with, if not on quite such liberal lines as those laid down by Mr. Selwyn, at any rate on lines very much extended in comparison with those that had existed during the last eight or ten years.

Mr. GEORGE G. MCCRAE then read a paper on the Coco-de-Mer, specimens of which were exhibited in the room. A copy of the *Botanical Magazine,* lent by Baron von Mueller, containing an account of the tree, was also handed round among the members. At the conclusion of the paper,

Mr. MCCRAE, in reply to the President, said that he had endeavoured to introduce the plant into Queensland by sending a nut to the curator of the garden at Bowen, but as he had heard nothing as to the result of the experiment, he had concluded that the seed had perished *en route.* He had tried another in a hot-house in Victoria, but this had proved to be a failure. However, he had been promised two more with the seeds well-protected, and expected to

receive them shortly. If they arrived safely, he would try them in Queensland. As to the statement that the islands Fraslin, Curieuse, and Ile Ronde had been considered by General Gordon to be the original Garden of Eden, he thought this was an error. The General had merely speculated on the possibility of such having been the case, but had alleged nothing. He had seen and verified the unpublished monograph by General Gordon on the Coco-de-Mer, which was very complete, the General having been an excellent draftsman, and having probably had the assistance, as to the botanical items, of his friend Mr. Scott, of Mauritius, with whom he had lived for some time.

Mr. GRIFFITHS said that two points had been referred to by Mr. McCrae, which he thought were of some interest. The first had reference to the very limited distribution of the tree, and the second to the geological character and features of the island upon which it was found. Far apart as the two subjects seemed to be, there was a connection between them. It was very singular that the Coco-de-Mer should be found on three islands and nowhere else in the world, and naturally such a fact had given rise to a great deal of speculation; but they had sufficient knowledge of the geology of the globe to have some idea, at any rate, of the steps by which such a condition of things had arisen. It was tolerably well established that, during the mesozoic period, there had been a continent in the Indian Ocean. This continent had had a shape which might perhaps be readily represented by a boomerang, and had stretched from the Cape of Good Hope (which was then isolated from the rest of Africa) through Madagascar and the region now represented by the islands Fraslin, Curieuse, and Ile Ronde, and, possibly, as far north as India. The Southern part of India at that time had been isolated from what is now Asia, and deep seas had rolled where the Himalaya Mountains now stand. It had then turned, answering to the curve of the boomerang, and stretched out to Australia, which at that time consisted of two parts—Western and Eastern Australia, between which was a wide shallow sea, and which were probably cut off from each other more or less completely. The existence of this ancient continent had been suggested by certain features in connection with the distribution of the fauna and flora of the world to-day, and the curious affinities which existed between Western Australia, South Africa, and parts of India.

This continent, in the secondary period, had gradually sunk beneath the ocean, and only isolated parts of it, among which were the Seychelles Islands, yet remained above water. Nearly all oceanic islands were of volcanic origin, but there were a few here and there that were not entirely volcanic, and contained rocks such as granite. Granite was never exposed, except as the result of denudation, which had been proceeding for a long period, and was only found so exposed in a very few isolated instances. The Seychelles he understood to be one of these isolated instances. New Zealand was another, and there were a few more in the Atlantic. Such a phenomenon was very rare, and the fact that those rocks existed in the Seychelles, was technical evidence that they were the remains of a continent that once existed. There was no doubt whatever that the islands were remnants of what had once been an extensive continent, and in this fact was to be found a clue to the limited distribution of the Coco-de-Mer. For the development of such a plant, a large area of land was required. There was no fact in the range of natural history better established than that. There could be no doubt that the Coco-de-Mer was developed when it flourished on a large continent—the mesozoic continent. As the land gradually sank beneath the ocean, and the area of dry land became more limited, the distribution of the tree had become limited in a corresponding degree; and, owing to causes which possibly could not be explained, the Coco-de-Mer had become extinct in all parts of the ancient continent, with the exception of Fraslin. They had similar instances of plants undergoing such changes. There was one island—Kerguelen, upon which not a single tree could be found, and yet under the basalt were to be found the huge trunks of beech and pine trees, three and four feet in girth, together with any amount of coal. This island had formed part of a continent, and as the land had sunk, its conditions had changed until they were such that trees could no longer exist, and had therefore perished. The Coco-de-Mer had probably perished in like manner, as all portions of the continent disappeared, until at last its remains were only to be found in Fraslin, and its stumps and roots, that had recently died in the small islands Ile Ronde and Curieuse. The peculiarities of the geology of the island were easily explained. They were not the result of catastrophies, as General Gordon had supposed, but were caused simply by the island slowly subsiding beneath the ocean.

Mr. McCrae, in reply to the President, said that some portions of the nut of the Coco-de-Mer were good for food, but were very insipid unless taken with sugar or wine. The nuts when polished were very beautiful, and were in two different colours—ebony and jasper. This difference in the colouring, however, he suspected to be a trick of the native jewellers.

Thursday, November 13th.

Mr. E. J. White (Vice-President), in the chair.

The minutes of the preceding meeting were read and confirmed.

Messrs. C. N. Hake and C. G. W. Officer were balloted for as Members, and Messrs. N. T. M. Wilsmore, Elderson Smith, and Mrs. Elderson Smith as Associates, and declared to be duly elected.

Mr. Frank Goldstraw was nominated for Membership.

In the absence of Dr. Neild, the Hon. Librarian, the Report was read by the Chairman, and showed that 104 publications had been received from various parts of the world.

Annual Election of Committees.

Gravity Survey Committee.—Mr. Love moved "That the Committee, consisting of Mr. Ellery, Professors Kernot, Masson, and Lyle, Mr. White, and Mr. Love (Secretary), with power to add to their number, appointed to consider and report upon a suggested Gravity Survey of Australia, be re-appointed." Carried.

Publishing Committee.—Mr. Griffiths moved "That the Publishing Committee for the following year consist of Messrs. Ellery, Griffiths, Masson, and Spencer." Carried.

Biological Survey Committee.—Professor Spencer moved "That the following Members form the Biological Survey Committee for the ensuing year: Wm. Bale, F.R.M.S., Rev. A. W. Cresswell, M.A., A. Dendy, D.Sc., A. H. S. Lucas, M.A., B.Sc. (Hon. Sec.), P. H. MacGillivray, M.A., M.R.C.S., Professor W. B. Spencer, M.A., C. A. Topp, M.A., LL.B., F.L.S., J. Bracebridge Wilson, M.A."

Antarctic Exploration Committee.—Mr. Rusden moved the re-appointment of the Antarctic Exploration Committee, consisting of Mr. Ellery, Mr. Griffiths, Professor Kernot, Mr. Rusden, Dr. Wild, Dr. Bride, Mr. J. G. Duffy, Mr. H. Gundersen, Mr. E. J. Hart, Mr. A. C. Macdonald, Baron Ferdinand von Mueller, K.C.M.G., Captain Pascoe, R.N., and Mr. Sachse. He said that the Committee had received letters through Mr. Gundersen, the Swedish Consul, from the Swedish Academy, offering on the part of Barons Nordenskiold and Dickson to form a Swedish-Australian Expedition, provided that Australia would contribute the sum of £5000 towards it, and Baron Nordenskiold undertook to lead it. The Committee had accepted the offer and promised to endeavour to collect the £5000 as soon as possible. Subscription lists had been prepared, and were now being circulated, headed by donations already promised amounting to £600 which sum would probably be augmented that evening by a vote of the Royal Society of £100. Preparations were in progress for giving a Grand Ball, by which it was expected that the Exploration Fund would acquire a fair accession, but more was expected from persons in positions like that of Sir Thomas Elder, who had offered £5000 towards Central Australian Exploration, and, if the cablegrams could be relied on, had since offered a like sum towards Antarctic Exploration. Several persons looked upon this Expedition as peculiarly the duty of Australia, and the number of persons who were acquiring a lively interest in it was daily increasing. If Sir Thomas Elder's offer were available for the proposed Swedish-Australian Expedition, the enterprise was almost a prospective certainty, as the amount required from Australia by the Barons was exceeded and Baron Dickson was understood to be prepared to furnish what more might be required.

Professor Spencer enquired whether it was proper to appoint a Committee formed partly of Members of the Royal Society, and partly of gentlemen who were not Members.

Mr. Rusden said that this was a Joint Committee consisting partly of Members of the Royal Society, and partly of Members of another Society.

Professor Spencer wished to know whether a Committee of the Society had power to add to its number gentlemen who were not Members of the Society.

Mr. WHITE thought the original intention was, that Committees should be composed only of Members of the Society.

Mr. BLACKETT thought that only Members of the Royal Society should be nominated. If other Societies coalesced with that Committee, that would be quite right; but he thought it *ultra vires* for the Society to nominate other gentlemen.

Mr. GRIFFITHS explained that the Royal Society nominated a certain number of gentlemen, as did also the Royal Geographical Society, and both Societies had agreed in conferring upon this Joint Committee the power of adding to their number; in consequence of which, certain gentlemen had been afterwards added to that Committee. The question now arose, should this Committee be re-appointed *in globo*, or only those gentlemen formerly appointed by the Royal Society, leaving the gentlemen on the Committee who were Members of both Societies to afterwards re-appoint the gentlemen who were outside.

The Chairman, Mr. WHITE, said they could simply appoint their own members, and if the Committee cared to appoint other gentlemen to co-operate with them, they would have power to do so. He would certainly withdraw from the list any who were not Members of the Royal Society.

Mr. GRIFFITHS said there was a possibility of the Geographical Society appointing a different Committee this year.

The Chairman, Mr. WHITE, said that if the Royal Society simply appointed their Committee, the Geographical Society might nominate theirs, and the Joint Committee could nominate other gentlemen.

Mr. RUSDEN said that the Royal Society had formerly nominated Professor Ellery, Mr. Griffiths, Professor Kernot, Dr. Wild, and himself. It would be sufficient to again nominate those gentlemen, and they would have power to add to their number if they thought proper.

This was agreed to and carried.

House Committee.—Mr. Rusden moved "That the House Committee, consisting of Mr. Blackett, Professor Kernot, Dr. Neild, Professor Masson and Mr. Rusden, be re-appointed." Carried.

The Royal Society's Subscription to the Antarctic Exploration Fund.

Mr. Alexander Sutherland, on behalf of the Council, moved, "That the sum of £100 be subscribed out of the funds of the Royal Society to the Antarctic Exploration Fund." He said he would like to enlist the sympathies of the Members of the Royal Society in favour of this movement. With one or two trifling exceptions, such as Northern Burmah and the back portions of some rivers of Brazil, every part of the world had been properly explored, but that near the South Pole, and this made a big blank indeed in the map of the world, and left it lamentably deficient. He would enlist the sympathies of the Members in the proposed scheme from a purely scientific point of view, purely for the love of science. Whale and seal fisheries might find a place, so to speak, in the tail of the movement; but if they had a divided interest in the matter, he thought the issue less likely to be satisfactory. Science, if properly carried out, never was barren of results, but those which followed, had generally been found to be the very opposite to those which had been expected. He would, therefore suggest, that they should go on simply for the love of science, and leave the beneficial results to follow in what shape they would. They had the chance of securing the services of Baron Nordenskiold, and it would be a very culpable thing if Australia were to let it slip. If Sweden, a nation certainly not superior to our own in resources, had done so much in the way of this class of exploration, surely it would be a slur on Australia, if it did not do the same amount of work for a region that lay close at hand. A number of scientific problems were awaiting solution in the Antarctic region, and there were probably 4000 or 5000 miles of coast to explore. It had been said that the South Pole must be buried under a mass of twenty miles of solid ice. If this could be proven, he thought it would appeal to anyone as being well worth the expenditure of a few thousand pounds to place such a fact upon a safe basis. There were also many other phenomena to study, and in short, we in Australia should be missing a very great chance of assisting in the scientific exploration of the world, if this scheme were not taken up. We should be also missing the opportunity of putting into the national pulse a strong beat of national life; because he did not think that anything

would really bind Australia so well together, as working for a common object, an object that would fire the national enthusiasm, so that all communities would feel interested in what Australia was doing. For these reasons, he would like to see the Society take the matter up. He would suggest a little alteration in the form of the motion. The Council had been unanimous in its decision. The money could not very well be spared, but in view of the immense results that were expected to follow, and the national character of the scheme, the Council was willing to stretch a point, and the Treasurer had stated that he was in a position to honour a cheque. He would rather, however, that the money should be left in the control of the Council, to be given by the Council on such conditions as it might think fit, so that, if any hitch should occur, the money should not lie locked up in a fund, *ad infinitum.* He, himself, had given a subscription five years ago to a project which had not yet come off, and the money had been lying idle all the time. Even Mr. Griffiths could not guarantee that the thing would be carried through, and their £100 might be paid into some fund, and lie there for the next twenty years. He had great pleasure in proposing the resolution.

Mr. Griffiths said he had very much pleasure in seconding the motion, and cordially supported all that Mr. Sutherland had said. Australia had shown herself very energetic and successful in the pursuit of material advantages, but on this occasion, they were asking the people of Australia to support a scientific project, purely for the sake of science. It was a project which, certainly, ought to be carried out by Australia, for the area which it was proposed to examine, lay within a week's sail of our shores. Baron Oscar Dickson had offered to send out this expedition, if Australia would find £5000 towards the cost of it. He (Mr. Griffiths) had gone into some detail with reference to this matter, and he was of opinion, that if two ships were sent out, although one of them was but a small vessel, the work could not be done for a less amount than £20,000. Baron Oscar Dickson had stated that he might be able to raise £5000 in Sweden; still his offer to send the Expedition if Australia would find £5000, meant that he himself would find £10,000, which was a very liberal offer. The Baron, however, was a very liberal man, and had already at his own cost, sent out seven different Expeditions to the Polar Regions. He was not, therefore, likely to be daunted by

the expense of the Expedition; and although the offer came from Sweden, they might be proud of the fact that the Baron himself was an Englishman.

Mr. DENDY suggested that some condition should be attached to the granting of the money. Would it not be possible that the Royal Society should be allowed to nominate a Member of the Expedition in consideration of the grant of £100?

Mr. GRIFFITHS said that this matter had not been lost sight of by the Antarctic Committee. The Members of the Committee were all fully seized of the desirability of having representatives, and the Royal Society was so strongly represented on the Committee, that he thought it might very safely leave the charge of this matter to those who had the Society's representation in their hands. He felt this more strongly because, if they took the stand suggested by Mr. Dendy, it would virtually amount to the Royal Society saying that by virtue of contributing £100 out of an expenditure of £20,000, it demanded the right of nominating a representative. If everybody contributing a similar sum could make a like demand, they would have a very good crew. However, it was the intention of the Committee to arrange with Baron Nordenskiold for power to nominate one or two gentlemen. The Committee also hoped to have the power of reserving cabin accommodation for representatives of the Press, because an Expedition of this sort ought to have its historian; the Press of Australia was energetic and he was quite sure it would not like to miss the opportunity of sending a gentleman who would be able to contribute an interesting account, apart from the scientific record. These matters had not been lost sight of, and he thought they should be left in the hands of the portion of the Committee representing the Royal Society.

Mr. BLACKETT quite agreed with what Mr. Griffiths had said, as regarded the inconvenience of making the vote conditional, and thought they might leave it to the Antarctic Committee to see that Australia was properly represented. With regard to the offer by Sir Thomas Elder, liberal as it was, he did not think that it should make the Members shut up their purses, either as the Royal Society or private individuals. He thought that not only should the Society give what it could out of the funds, but that the Members should also make an effort to give something to show their personal

interest in this scientific expedition. If they gave what they could afford, whatever it was, it would be an evidence to Baron Oscar Dickson, and those who took an interest in the matter, that Australia was bound to support them in a generous way.

Mr. RUSDEN thought the offer of Sir Thomas Elder of immense advantage, it being a splendid example to a great many in Australia who were in a position to do the same thing. At the same time, he did not know that they could rely upon anything that only appeared in a telegram, without corroboration. He might also mention that in a letter to the Swedish Academy accepting so far as was possible Baron Nordenskiold's offer, although it was stated that no doubt he would have the right to take with him whom he would, yet the names of Professor Spencer and Mr. Wragge, of Brisbane, were mentioned as candidates to accompany the Expedition, in terms which would show that they were suitable persons, and quite as good as any he could find. He therefore thought the objects suggested by Mr. Dendy had been conveyed in more delicate terms.

Mr. DENDY asked to be allowed to withdraw his motion, as he thought it had been made sufficiently clear that it was unnecessary.

The motion, as proposed by Mr. Sutherland, and seconded by Mr. Griffiths was then put and carried unanimously.

A MEMBER moved, "That the Secretaries be instructed to send out circulars to the Members for private subscriptions." He thought a good many subscriptions could be obtained in that way. He would like also that subscriptions which came from Members of the Society should go into a common fund, and should appear as Royal Society subscriptions. This resolution was carried.

A paper entitled "A Description of New and Little-known Polyzoa, Part XIV," by Mr. P. H. MacGillivray, M.A., M.R.C.S., was described to the meeting by Mr. Wilson, and taken as read.

A paper entitled "The Dukduk Association of New Britain," by the Rev. R. H. Rickard, presented by the Rev. Lorimer Fison, was read by Professor Spencer.

Mr. BLACKETT said it would be interesting to know whether the English word "taboo" had had its origin in

some way from the rites and customs of the natives in that part of the World.

The Chairman (Mr. WHITE) said that the word had not been known before Captain Cook's description.

Mr. SUTHERLAND said that this custom, or something nearly approaching it, was found all over the World. Bates in his "Travels in Amazon," Wallace and other authors had described the same thing. It started apparently from the childish idea of putting on masks; but when it was found that people could be frightened, the proclivities of the natives in the direction of the suggestion of supernatural causes had led to this custom becoming semi-religious in character.

Mr. WILSON said that Dukduk was mentioned in a recent work by Fraser, wherein it was described as a ceremony marking the passage from boyhood to manhood. According to Mr. Fraser, its chief feature was a representation of death and resurrection, the young fellow who was to be initiated receiving a blow which was supposed to cause his death, and certain ceremonies afterwards being preformed which were supposed to bring him to life.

A paper "On Two Rare Hydroids from Port Phillip" was read by Professor W. Baldwin Spencer, who illustrated his remarks by a number of charts and blackboard drawings.

Mr. DENDY remarked that it was not surprising that Dr. Gray had described the Ceratelladæ as sponges, as in external appearance they bore the strongest resemblance to some of the horny sponges. Not only was this so, but the skeleton of the Dehitella, and that of certain horny sponges, were almost identical. Mr. Carter had decided that they were not sponges, because he had found thread cells in them—thread cells being characteristic of hydroids. Another worker had found thread cells in an undoubted sponge, and had therefore jumped to the conclusion that sponges contained thread cells; but it had been found later on that the thread cells did not belong to the sponge, but to a hydroid parasitic upon the sponge. This had led him (Mr. Dendy) to think that it was not altogether impossible that these might be composite forms—a combination of a dead sponge with a hydroid growing parasitically upon it. Horny sponges had skeletons very similar to those of the hydroids just described. Dr. Schulze in his "Challenger Report" described a hydroid parasitic. Dr. Gray thought that the

forms were sponges, and Mr. Carter thought they were hydroids. Was it not possible to reconcile these different views? He thought it probable that originally it was a sponge upon which a hydroid was parasitic, and that the hydroid grew so as to kill the sponge, and then remained master of the situation.

Professor SPENCER said that, although there was no doubt whatever that hydroid forms did live parasitically upon sponges, and that therefore the suggestion was rather a taking one at first sight, still the balance of evidence was strongly against this theory in the case of Dehitella and the form now described, which, in their skeleton, were very similar in many respects to Hydractinia, and were undoubted hydroids.

An Appendix to remarks on "The Older Tertiary Strata at Bairnsdale" was read by Mr. John Dennant, F.G.S.

Thursday, December 11th.

The President in the chair.

The minutes of the preceding meeting were read and duly confirmed.

Mr. Grayson and Mr. Best, as Associates, and Dr. Syme, as a Member, signed the Roll, and were introduced by the President to the meeting.

Mr. Alfred Reeve was nominated as a Member.

Mr. Frank Goldstraw was balloted for as an Associate, and declared duly elected.

NOMINATION OF OFFICE-BEARERS AND MEMBERS OF COUNCIL.

The President (Professor KERNOT) stated that the offices of President, Treasurer, Secretary and Librarian, as well as three vacancies in the Council, would have to be filled by ballot at the next General Meeting, which would be held in March. Nominations might be sent in at any time before the first day of March, by letter addressed to one of the Secretaries; but it was better that Members, if they took any special interest in the matter, should send in their nominations at once. The following were the names of the retiring Officers and Members of Council :—President—

Professor Kernot; Vice-Presidents—E. J. White, F.R.A.S., and J. Cosmo Newbery, C.M.G.; Treasurer—C. R. Blackett, F.C.S.; Librarian—J. E. Neild, M.D.; Secretaries—H. K. Rusden and W. Baldwin Spencer, M.A.; Members of Council—A. W. Howitt, F.G.S., J. Jamieson, M.D., A. H. S. Lucas, M.A., B.Sc., Professor Lyle, M.A., A. Sutherland, M.A., and A. S. Way, M.A. The non-retiring Members were:—R. L. J. Ellery, F.R.S., G. S. Griffiths, F.G.S., Professor Masson, M.A., D.Sc., and H. Moors. Two vacancies for lapsed seats also required to be filled.

Dr. NEILD moved the re-election of Messrs. Fenton and Moors as Auditors.

Mr. RUSDEN seconded the resolution, which was put to the meeting and carried.

Dr. NEILD, the Hon. Librarian, reported that 110 volumes had been received since the preceding meeting.

Mr. DENDY read a paper entitled "Monograph of the Victorian Sponges, Part I. The Anatomy and Classification of the Calcarea Homocœla, with Description of the Victorian Species," illustrating his remarks by a number of diagrams and blackboard drawings. At its conclusion, Mr. Dendy was accorded hearty applause.

The PRESIDENT said that Mr. Dendy had not only succeeded in bringing to light a number of interesting facts in connection with the sponges he had described, but also in rendering them clear to those who were not experts. There was something exceedingly attractive in the study of these low forms of life; and it certainly was interesting to learn that on Victorian shores a sponge had been found presenting a structure as to which the best Spongologists had been sceptical, and of a size rendering it capable of easy examination. He congratulated Mr. Dendy, not only on the interesting discoveries he appeared to have made, but also upon the admirable diagrams that he had specially prepared for their enlightment that evening.

Professor SPENCER said it was almost impossible to discuss such an interesting and valuable paper at short notice. Mr. Dendy was to be congratulated on the commencement of his work on sponges. When he would bring it to a close, he could not tell, seeing the large number of specimens on which he was engaged; but he hoped that the Society

would be able to publish his work in full, and to devote at all events, one volume of its Transactions to it. It would be perhaps one of the most valuable papers the Society had published. Mr. Dendy's remarks, especially with regard to classification of the groups, were very interesting as showing that there were three gradations in form to be met with among the different members of the group Calcarea Homocœla; and that it was practically impossible to divide them into a series of species clearly marked off from one another, but that they were to be regarded simply as varieties of one group, more or less complicated. Perhaps one of the most interesting points was, the curious modification by which the collared cells in one of the types described, seemed at first sight to have changed their positions with regard to the tubes, the walls of which they lined. Mr. Dendy's diagram had taken a considerable amount of thinking out, and, from what he (Professor Spencer) had seen of the specimens, accurately represented what really took place. There were a number of other interesting points to which he would like to allude, but it was practically impossible to discuss such a paper on the spur of the moment. He could only congratulate Mr. Dendy and the Society on the work which had been done.

The PRESIDENT thought that Mr. Dendy had not given full information as to the dimensions of the specimens he had described. Of course, in a diagram, things were drawn to various scales, and the relative sizes could not be at once understood.

Mr. DENDY, in reply, said he had worked out the dimensions of a number of forms. The collared cells were extremely minute, and were invisible to the naked eye. The largest spicules were just visible. The inhalent pores were invisible to the naked eye, and required a fairly high power microscope to define them distinctly.

Professor SPENCER then read a paper entitled, "Notes on some Victorian Land Planarians."

At its conclusion,

The PRESIDENT remarked, that the present addition to the information they already possessed appeared to be very interesting. The district from which the specimens had been obtained was characterised by a high rainfall, dense

vegetation, and high altitude above the sea. He would like to know, whether Professor Spencer had traced any effect of the altitude above the sea on the distribution of the species. The district which had been visited averaged about 3000 feet above the sea and was noted for a comparatively heavy rainfall. It was a curious thing that such an animal, apparently so soft and feeble, should be able to destroy the formidable beetle, with its hard armour and sharp claws. The description of its proceedings reminded one of a boa-constrictor dealing with a bullock. It would be interesting to know whether the unfortunate beetle made any desperate attempts to rend its persecutor, or whether it succumbed to its fate.

Professor SPENCER said that, with regard to the forms procured from the special district in question, they were notable for being nearly all dark coloured, the light coloured species being remarkably absent. As to their food, the Geoplanas undoubtedly kill a great number of beetles.

Mr. HOGG said it was interesting to see the number of new species which were the result of almost every expedition made by Professor Spencer and Mr. Dendy. He thought the reason why they had not seen so many of them before, was because sufficient attention had not been given to them. He himself could testify to the large number of creatures which these worms eat. He had placed some planarians and moths together in a box, and a large moth, nearly two inches long in the body, had been completely cleared out by three or four planarians. With reference to what the Professor had said about the classification of the planarian according to the even or odd number of its stripes, this was a matter to which he had always felt some difficulty; because, although the body shapes were very persistent indeed, it always seemed to him that the stripes were not nearly equally so. The Professor had clearly shown the difference between the species, but he had often found that the stripes in what appeared to be the same species were very faint, and sometimes hardly existant. There were indications of them at one end of the planarian possibly, but they were not always persistent down the planarian, and seemed to him to vary considerably. This was a matter that wanted a good deal of consideration before it could be shown that the persistency was so great that the species were to be determined by it. The colours certainly varied in some small degree, and he

thought this depended a good deal on the nature of the shade in which they lived. When some were found living more out in the open than others, their colours were very much more brilliant. The colours of those found living in more shady places were not so brilliant. Another curious point was the large number of different species often found huddled together beneath the same log. In this position he had frequently found as many as four, and sometimes five species; and this at first had seemed to him a strong reason for believing that their stripes were not an indication of their different species. However, since he had seen how persistent the shapes of the body were with the stripes, he had come to consider that the stripes should have much more weight attached to them. Still, they very often disappeared; the thin ones certainly did, and therefore he thought they were hardly sufficient to make a classification by.

Mr. DENDY said that the main point was, that the species were distinguishable, and that the planarian could very easily be identified. All the old species had been identified at a glance. The stripes varied a little in distinctness, but the body shape and arrangements seemed to be always constant, and the position of the external apertures were good guides. The external appearances were quite sufficient to enable one to define the species. As yet, only one species had been worked out anatomically, but it was hoped that this work would be continued, when it would be shown how the internal anatomy agreed with the external appearances. Professor Von Graff had written to him, informing him that he was writing a Monograph, and he (Mr. Dendy) had sent him thirteen species. He had received a letter from the Professor stating that he was cutting these specimens into sections, and it was therefore hoped that his observations would be able to appear together with their own, so that a better idea would be gained as to how far planarians are recognisable as distinct species. With regard to the different species occurring in different localities, it was a striking fact that every region seemed to have its particular planarian fauna. There seemed to be a particular set of planarians characterising each district.

Mr. RALPH then read a paper entitled, "Observations and Experiments on the Coloured Material of the Red Corpuscles."

At its conclusion,

Dr. NEILD said that Mr. Ralph had raised the question—To what end? One might put the same question perhaps to most of the investigations which, having been worked out, had eventuated in remarkable practical benefit to the world at large. One point which impressed him was, should we in this way discover some method of treating those diseases in which these molecular changes take place? Without doubt, there was a very remarkable change in the corpuscles of the blood in many of the diseases that had engaged the attention of the medical profession and the scientific world generally, many of which were practically hopeless of treatment. He hoped that Mr. Ralph would attain the end at which he aimed, and that one day he would be able to say, by examination of the blood of a patient, from what particular disease he was suffering, and to determine with mathematical exactness what treatment to adopt. He was sure that every credit would be given to Mr. Ralph for the extraordinary industry and perseverance he had shown in this matter.

Dr. JAMIESON said that the changes observed by Mr. Ralph, were partly chemical and partly physical. He would have been better pleased if Mr. Ralph had recognised more specifically the fact that hæmoglobin was simply a soluble substance, capable of being crystallised and entering into chemical compounds, oxydised and de-oxydised; and, so far as he understood our knowledge to go, was a substance diffused through the corpuscle, and capable of escaping from the corpuscle into the liquid element of the blood. How far the concentration of the diffusion could be regarded as being due in any way to an independent action of the hæmoglobin itself, he had not been able to understand from the observations of Mr. Ralph, who seemed to speak of it as something capable of undergoing or exercising active changes, and not (as it seemed to him) as something passively diffused, perhaps in the corpuscle itself, perhaps round about it. He did not understand very well what particular significance Mr. Ralph attached to the hæmoglobin, what he recognised it to be, or what influence it was supposed to exert; whether he considered it something different from what it was generally supposed to be, viz., a chemical substance, capable of solution in water, and probably diffused through the stroma of the red corpuscle. There was no

doubt whatever about the amount of work that had been devoted to these experiments, and as all work honestly carried out led to some useful result, he hoped that this would also lead to something beneficial. The experiments, however, seemed somewhat disconnected, and did not give one an idea of what they were leading up to, and he would be glad if some generalisation could be obtained.

Mr. RALPH, in reply, said that he called the hæmoglobin the coloured material of the red corpuscle, in order to simplify the matter. He was satisfied that all the changes were due to the same material. As to generalising, these were his experiences in the rough. He had found comparatively similar results in typhoid and scarlatina, and lately in diphtheria blood. He had also experimented with the blood in cases of leprosy. In all these cases, the same disturbance took place in the coloured material. In such cases, there was an action on the blood analogous to the the violent action of nitric or any other acid, and he would be very glad at any time to show these experiments to any one, more especially to his professional brethren.

The PRESIDENT stated that the question of the Antarctic Expedition was progressing favourably. For the purpose of procuring funds, a ball was being organised, and would take place on the 19th inst., under the patronage of His Excellency the Governor. He hoped that the members would do all in their power to help forward the movement in any way that met with their approval. Of course, it might perhaps be said that balls were not scientific proceedings, but the question was, how to get a sufficient amount of money to put beside Baron Dickson's grand offer. £5000 would have to be raised very shortly, if preparations were to be made for starting the Expedition next summer, and it was highly desirable that it should not be delayed later than that. He believed that a good deal of sympathy and assistance would be received from other colonies, but there was no shutting our eyes to the fact, that the brunt of the movement—the bulk of the burden—would have to be borne on Victorian shoulders. He hoped Members would do all they could to help this matter forward. There was an immense number of interesting points in Biology, Meteorology, Geography, and many other sciences to be determined by such an Expedition. It was now a very great many years since anything like a

properly equipped Expedition had found its way into high Southern latitudes. The "Challenger" had not gone so very far South, although it went within sight of the ice barrier. It was hoped that this Expedition would be able to get a good deal further South than any vessel had gone within the last forty years, if indeed it did not go further South than any vessel ever yet had gone. One reason for expecting this was, that the vessels would have steam power. In the high Southern latitudes comparative calms or light winds prevailed, and the sailing vessels were comparatively powerless and unmanageable. A steamer could go and return where a sailing vessel could not venture. To attempt the South Polar regions by the aid of steam power, was the object of the Expedition. £5000 had to be contributed by the Colonies, and the amounts promised and received in Melbourne were approaching £1000. This was not a great way towards £5000. He did not know exactly how far the matter had got in the other Colonies. This was the position the Antarctic question was in, and he trusted that Members of the Royal Society would render every assistance to this most desirable object.

In conclusion, he would again remind them that this was the last meeting of the year, and that they were about to enter on their long vacation. The next meeting, which would be held in the following March, would be the Annual Meeting, at which the Annual Elections would take place, and he trusted the nominations would be sent in in due time. He thanked the Members for their attendance, and congratulated the Society on what had been a very satisfactory Session, thanks mainly to the labours of those interested in Biology. He would declare the Meeting and the Session of 1890 at an end.

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Art. I.—*Preliminary Account of Synute pulchella, a New Genus and Species of Calcareous Sponges.*

By Arthur Dendy, D. Sc., F.L.S.

[Read March 12, 1891.]

The sponge which forms the subject of the present communication exhibits a very interesting modification of the usual Sycon type of Calcisponge organisation. If we imagine a colony of the Sycon genus *Ute,* whose component members, growing more or less vertically upwards side by side, have become fused together completely, so that the whole colony forms a single vallate mass in which the individuals can only be recognised externally by their oscula, we have then a tolerably accurate conception of the new genus *Synute.* The fusion of the Sycon individuals of which the colony is composed is complete (extending right up to the oscula) and universal, and by no means partial or accidental, and the entire colony is protected on the outside by a thick common cortex consisting mainly of huge oxeote spicules.

Vosmaer* gives the following diagnosis of the genus *Ute*:—"Tubarskelet gegliedert oder nicht. Peripherisches Skelet hauptsächlich aus grossen, in Schichten gelagerten Stabnadeln bestehend."

We may diagnose the genus *Synute* as follows:—"Sponge forming a colony of Sycon individuals completely fused together into a single mass invested in a common cortex.

* "Porifera," Bronn's Klassen und Ordnungen des Thierreichs, p. 372.

Tubar skeleton articulate or inarticulate, cortical skeleton formed chiefly of huge oxeote spicules arranged in several layers and lying parallel to the long axes of the Sycon individuals."

For the single species at present known I propose the name *Synute pulchella.*

SYNUTE PULCHELLA (n. sp.)

General Appearance and Canal System.

The colony (of which a single specimen only has as yet been obtained) resembles in general form a small specimen of Mr. Carter's *Teichonella prolifera.** It consists of a number of stout vertical walls, nearly a quarter of an inch in thickness, which branch or divide in such a way that the upper surface of the sponge presents a characteristic mæandriniform appearance. Along the mæandering ridge which forms the upper surface of the sponge small oscula are arranged, nearly always in a single row. These oscula are less than 1 mm. in diameter and they have no oscular fringe, neither are they raised on papillæ, for the fusion of the Sycon individuals (one of which corresponds, of course, to each osculum) is complete up to the very top. The sides of the walls exhibit a beautifully striated appearance, due to the large oxeote spicules of the cortex, which can be distinguished with the naked eye, although they do not project beyond the surface. The entire colony is somewhat constricted towards the base, so that the fused individuals composing it tend to radiate outwards and upwards from a common centre. The whole colony is about 38 mm. in greatest width and 18 mm. in height. It is attached to the surface of another, much larger, non-calcareous sponge, and in spirit is of a pale grey colour, nearly white.

The canal system, apart from the fusion of the Sycon individuals, closely resembles that of *Ute argentea* as figured by Poléjaeff.† A horizontal section of the colony

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* Figured in my paper "On the Anatomy of *Grantia labyrinthica* Carter, and the so-called Family Teichonidæ." *Quarterly Journal of Microscopical Science*, January 1891. Plate I, Fig. 6.

† Challenger Calcarea. Plate IV, Fig. 3.

shows a number of circular spaces scattered at intervals, generally, but not always, in a single row. These are the gastral cavities of the Sycon individuals cut across. Each is completely surrounded by the thimble-shaped flagellated chambers, or radial tubes, which radiate outwards from the gastral cavity. On the adjacent sides of two neighbouring gastral cavities the radial tubes are shorter than on the outer sides.

The inhalant pores are not visible to the naked eye and are merely narrow interstices between the outer spicules of the cortex, leading into irregular canals which pierce the cortex to reach the flagellated chambers, exactly as in *Ute argentea.* At their lower ends the gastral cavities of the fused Sycon individuals communicate with one another, indicating that this peculiar form of Sycon colony has arisen from fusion of adjoining individuals of a branching colony such as *Sycandra arborea.*

The flagellated chambers or radial tubes are approximately octagonal in transverse section, while the much smaller inter-spaces between them are square. The gastral (exhalant) openings of the chambers are protected by very well developed membranous diaphragms. Each gastral cavity has also a single large well-developed diaphragm situate just within the osculum.

The Skeleton.

The skeleton, as in *Ute argentea,* is very complex and may be divided into Cortical, Tubar, Gastral and Oscular portions.

The Cortical Skeleton.—This consists (1) of very large, fusiform oxeote spicules, slightly curved, fairly symmetrical in shape and gradually and sharply pointed at each end. Size when fully developed up to about 3·0 by 0·14 mm. These are arranged parallel to the long axes of the gastral cavities and in several layers; (2) Between the above are a few smaller oxea and great numbers of comparatively small triradiates. The latter although apparently disposed in the utmost confusion and frequently of irregular shape, generally show a marked tendency towards the sagittal type, the oral angle being decidedly wider than the lateral. The rays are

conical and gradually sharp-pointed and measure about 0·072 by 0·01 mm. The basal ray may be of about the same length or shorter or longer than the others, and is perhaps generally directed somewhat downwards towards the base of the sponge; (3) On the surface of the sponge, outside the giant oxeote spicules, is a layer of very minute oxea arranged at right angles to the surface and hence also at right angles to the large oxea, and each with one end projecting very slightly, if at all, beyond the ectoderm. These oxea are very slender, measuring at most about 0·07 by 0·003 mm. They are very gradually sharp-pointed at their inner ends and somewhat hastately sharp-pointed at their outer ends. They are straight or only slightly curved.

The Tubar Skeleton.—The tubar skeleton is articulate and thus differs from that of *Ute argentea.* It is composed of sagittal triradiates arranged according to the usual Sycon plan, and the number of joints depends, of course, upon the length of the chamber; sometimes there may be as many as a dozen. The sub-gastral sagittal triradiates, forming the proximal joint of the skeleton, are, as usual, rather different in shape from the remainder of the sagittal spicules constituting the tubar skeleton. The oral angle is nearly 180°; the oral rays are slightly curved away from one another towards the basal ray, they are conical, gradually sharp-pointed, and measure about 0·084 by 0·01 mm. The basal ray is straight, conical, very gradually sharp-pointed, measuring about 0·14 by 0·01 mm. There is a more or less gradual transition between these sub-gastral sagittal triradiates and the more distally placed spicules of the tubar skeleton. The oral rays first become approximately straight and spread out nearly at right angles to the basal ray; then, further away from the gastral cavity, they begin to curve towards one another away from the basal ray, and the oral angle is somewhat reduced. At the same time the basal ray becomes shorter, until it is only about the same length as the orals (now about 0·07 mm.) All the rays still remain conical and gradually sharp-pointed.

The Gastral Skeleton.—This consists of quadriradiates and triradiates, backed by the oral arms of the sub-gastral sagittal triradiates. The quadriradiates are stout sagittal

spicules having the apical ray projecting outwards and slightly upwards into the gastral cavity. The oral angle is a good deal wider than the lateral, and the oral rays often markedly longer than the basal, measuring, for example, 0·15 by 0·014 mm., as against 0·084 by 0·014 mm. The disproportion, however, is not always so great as this, nor are the spicules always so large. The rays are stout, conical and gradually sharp-pointed, and the oral rays curve slightly away from one another. The apical ray is usually short and stout, conical, gradually sharp-pointed and nearly straight, although inclined upwards; usually only about 0·056 mm. long, rarely a good deal longer. Amongst these quadriradiates are found a number of sagittal triradiates, while at a short distance below the osculum the quadriradiates gradually disappear, leaving triradiates only. We may call these latter the sub-oscular gastral triradiates. The sub-oscular gastral triradiates are arranged very regularly, like an articulate tubar skeleton, with the basal rays all pointing away from the osculum. They are all sagittal; at first (*i.e.*, away from the osculum) the basal ray is the longest and the oral rays are nearly straight, diverging at a very wide angle. All the rays are conical and gradually sharp-pointed. The oral rays measure about 0·1 by 0·01 mm. and the basal about 0·14 by 0·008 mm. On approaching the osculum these sagittal triradiates gradually become smaller and their shape gradually changes, the basal ray becoming very short (much shorter than the oral rays) and the oral rays spread out almost in a line with one another. The rays are still conical and gradually sharp-pointed. In the extreme form, found just within the osculum, the oral rays may still measure about 0·1 mm. in length while the basal is reduced sometimes to 0·02 mm. and is also much slenderer than the orals.

The Oscular Skeleton.—This consists of a closely packed layer of long, slender oxea arranged vertically side by side around the osculum, but the greater part of the spicule is imbedded in the wall of the gastral cavity, so that there is no conspicuous oscular fringe. These oxea, except for their much greater size, resemble the small surface oxea of the cortical skeleton. They are long and slender, usually gradually sharp-pointed at their inner ends and irregularly hastate at their outer ends. They measure about 0·3 by

0·01 mm. For the greater part of their length these spicules are imbedded amongst the sub-oscular gastral triradiates and they extend some way below the oscular diaphragm.

The specimen upon which the above account is based was dredged by Mr. J. Bracebridge Wilson, M.A., in the neighbourhood of Port Phillip Heads, Victoria.

Art. II.—*On a New Species of Dictyonema.*

(With Plates I and II.)

By T. S. Hall, M.A.

[Read March 5, 1891.]

The first specimen I saw of this fossil was a fragment given to me in 1889 by Mr. Clark, a student in geology at the Working Men's College. In company with Mr. G. B. Pritchard, I paid a visit to Lancefield, where the specimen had been found, and about five miles north-east of the township we found the quarry. The rock is a soft black slate, dipping at a very high angle, and containing a great deal of iron pyrites, both in nodules, and in disseminated grains. The rock is marked lower silurian on the geological map, and is very near the boundary of the upper silurian which lies to the eastward. We were fortunate in finding numerous fragments of the fossil preserved in a white talcose material and accompanied by graptolites. In turning over a heap of *débris* from the quarry, I found the large slab I have figured covered with mud, but still distinctly showing that I had secured a specimen exhibiting the centre of the polyp-stock. One of the fragments found by Mr. Pritchard fitted on to the larger piece as shown in the lower left hand of Figure I.

Dictyonema is closely allied to the graptolites, but the chitinous supporting rod, so characteristic of the latter, is wanting in the former.

Genus Dictyonema.

Sub-Order—Campanulariæ; Order—Hydroida.

Zittel ("Handb. d. Pal., Bd. I.") gives a definition of the genus which I translate as follows:—"Hydrosome, funnel pannier or fan-shaped, with numerous branches almost parallel, strong, forked and united by cross threads. The ends of the branches are free, and are then set on one side with pointed hydrothecæ. The latter appear very perishable and are exceedingly seldom preserved."

D. GRANDE (n. sp.)

Polyp-stock large, flat, with perhaps the exception of the central portion, which, judging from the distorted condition in which it is preserved, was slightly cup-shaped. The centre is formed by a thread about 2 mm. in length. From each end of this are given off two branches, which, at about 1 mm. from their point of origin, bifurcate nearly at right angles, thus producing eight branches. The outer edges of the branches forming the right angles are straight, and at about 5 mm. from their origin unite, enclosing an elongated fenestrule. The inner edges curve sharply and unite, enclosing a circular fenestrule about 3 mm. in diameter. After this, branches about 1 mm. wide radiate in every direction from the centre, branching dichotomously as they go, and no anastomosis occurs. The branches are united by cross bars which as a rule run nearly at right angles to them, but are in a few cases oblique. The bars are broadened at their junction with the branches, as in the Canadian species described by Prof. James Hall (Can. Org. Rem., Dec. II), and are about 1 mm. wide at their middle. The cross bars cease their appearance at from 2 to 4 cm. from the distal end of the branches which then become very flexible and attenuated. The distance between two adjacent bifurcations of the same branch varies from about 1·5 to 7·5 cm. The fenestrules enclosed by the radiating branches and the cross-bars are generally about 5 mm. wide, and vary from 5 to 25 mm. in length, those towards the centre being smaller and more circular in outline.

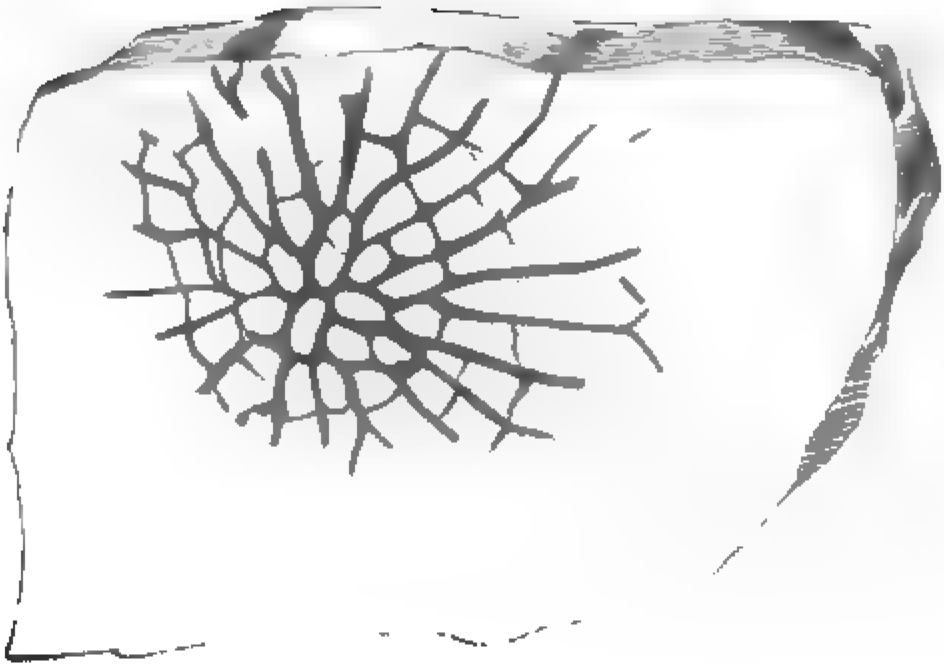
The diameter of a perfect specimen has not been determined, and the hydrothecæ are not visible in any of the specimens.

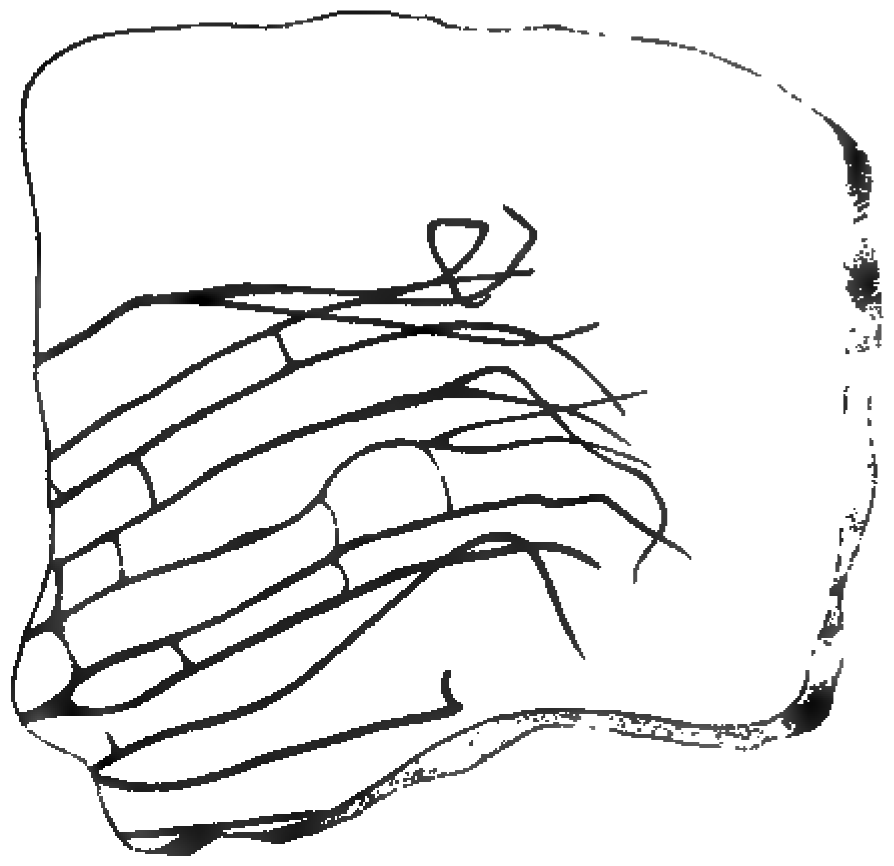
My best thanks are due to Professor W. Baldwin Spencer for his advice during the preparation of this paper.

DESCRIPTION OF FIGURES.

1. Central portion.
2. Fragment showing termination of branches.
3. Central portion of another specimen.

The figures are natural size.





ART. III.—*Notes on the Lower Tertiaries of the Southern Portion of the Moorabool Valley.*

(With Plates III and IV.)

By T. S. HALL, M.A., and G. B. PRITCHARD.

[Read March 5, 1891.]

The occasion of the visit of the University Science Club to Geelong for their long-vacation trip enabled us to make some observations on the geology of this locality.

The course of the stream, from its sources to the eastward of Mount Warrenheip down to its junction with the Barwon at Fyansford, near Geelong, is across the eastern portion of the great volcanic plain of South Western Victoria. Like most of our streams flowing through basaltic country, it has cut a deep and narrow valley of its own, and has in many places exposed the underlying deposits. In the upper part of its course, these underlying deposits are of lower silurian age, while in its lower part they consist of tertiary strata.

Our observations dealt principally with the older tertiary deposits, and extended from the railway viaduct, near Batesford, down to the junction of the stream with the Barwon at Fyansford.

GRANITE.

The oldest rock exposed is the granite, an outcrop of which, about a square mile in extent, occurs at the Dog-rocks near Batesford. Another outcrop, a few yards in extent, occurs where the Maude Road crosses Sutherland's Creek at Darriwill, ten miles from Geelong; and probably granite occurs at no great depth beneath the surface everywhere between the Dog-rocks and the granite hills of the You Yangs.

the foraminifera persisted during the time required for the deposition of the first few feet of the clay. The muddiness of the water, however, was apparently inimical to the growth of polyzoa in the profusion in which they had previously existed, and they soon ceased to be the typical forms of life in the locality, and the gastropods made their appearance in greater numbers. The effect of the variation in the sediment on the fauna has been alluded to when dealing with the section near the viaduct.

The section is as follows:—

Basalt	60 ft.
Incoherent sandy material, with concretions	20 ,,
Yellow clay, with concretions ...	50 ,,
Grey clay	20 ,,
Polyzoal limestone	30 ,,
Total ...	180 ft.

The hill side is covered by a fairly deep soil, but in a few places, especially where rabbits have burrowed, the underlying rock is exposed. Fossils are scarce, but by dint of a few hours' careful searching, we succeeded in securing examples of thirty-five species, which will be found recorded in the list given.

Below Madden's, the river valley widens out to about three-quarters of a mile. The bed of the stream is formed by the polyzoal limestone for a distance of about half a mile below the section just described, and the rock is carved into miniature caves and hollows by the stream. The top of the limestone approaches the level of the river as we go down stream, owing to the dip of the beds, and at last it disappears under the bed of the stream, its place being taken by the overlying grey clay. Just above Griffin's (see plan 5), where the clay first makes its appearance in the river bed, fossils are plentiful. The banks of the stream are steep and slippery, so that it is a matter of some difficulty to work at the beds. The top of the clay bed is only about a couple of feet above the summer level of the river, and its eroded surface is covered by a gravel wash some ten or twelve feet in thickness.

The fossils found here were remarkable for their size, being far larger than examples of the same species occurring

elsewhere in the valley. We record 113 species from this locality.

For about half a mile below this the river bank exposes an almost continuous section of the clay bed, but this at last disappears, and is overlain by the gravel wash which covers the greater part of the valley.

To the northward on the hill side bounding the valley at (3) and (4), small exposures of the yellowish clay were seen, but only a couple of fossils were obtained. The hill side is thickly masked by soil, principally derived as a pluvial wash from the basalt above. In the places mentioned, however, small gullies have exposed the tertiary rock, though the exposures were so small that we could do no more than satisfy ourselves that the beds were continuous in that direction. Near Coghill's (see plan 2), the stream which has hitherto held a general south-easterly course, bends away to the southward. At this point, a very steep cliff is formed, exposing a section, which attracted the attention of the officers of the Geological Survey. At the base of the cliff occur billowy hillocks formed by the weathering of a small landslip.

The geological survey sheet gives the following section :—

Black loam, with estuary shells and nodules of limestone	8 ft.
Lava	30 „
Loose sand	6 „
Sandy clays, with miocene tertiary fossils	56 „
Total ...	100 ft.

This section, however, seems to need several modifications. The upper surface of the basalt is wackenitic in character, and passes up into the surface soil, and we could not find any trace of the estuary deposit referred to. After a prolonged search, about a dozen specimens of shells were discovered lying close to one another, on the face of the slope towards the cliff. These were all recent species, and are not peculiarly estuary shells. Their colours were perfectly preserved, and they did not appear to have been long in the position in which they were found. The shells were of species of large size, and no examples of small shells were found. The height of the place above the sea

is about 200 ft., and there is no evidence elsewhere, of such a great elevation of the coast within recent times. It seems probable that the shells were carried there by human agency, as similar collections of shells forming the "kitchen middens" of the blacks, are not unknown in other places. A careful examination of the soil did not show any quartzose sand, and the ant-heaps near the spot are covered with small pieces of scoriaceous basalt. Had there been any quartz sand in the deposits, traces of it would certainly have been found on the ant-heaps. Limestone nodules occur, but they are not unknown in decomposed basalt nearer Melbourne, and similar masses may be found near the railway cutting in Royal Park, the lime being probably derived from the decomposition of a lime felspar. A few angular fragments of quartz and quartzite were found on the surface, but are exceedingly scarce. There is certainly no evidence of a marine deposit overlying the basalt anywhere near this locality.

With regard to the 6 ft. of loose sand mentioned on the quarter-sheet, as underlying the basalt, this seems very local in its development. In most places, the clay beds which, as before mentioned, become more sandy in their upper portion, are directly overlain by the basalt, but in a few spots, loose sand does occur. There is no difference in colour between the loose sandy beds, and those containing a small admixture of clay, both being fawn-coloured. The bed of sand is marked Older Pliocene on the map, and is represented as having a continuous outcrop for miles up the valley. The evidence for its separation from the underlying beds is exceedingly slight.

We record 106 species from this locality.

From Coghill's to the Orphanage Hill, the ridge on the left bank maintains a fairly uniform height of about 200 ft. above the river, and falls away gradually on the eastward towards Corio Bay. The country on the right bank had evidently suffered extensive denudation before the basalt outflow took place. The survey quarter-sheet shows the basalt coming right down to the river's edge, from Coghill's to Fyansford (its upper surface being only about 50 ft. or 60 ft. above), while on the other bank, the base of the basalt is about 170 ft. above the river. It is possible, however, that the face of the hill is merely covered by the *debris*, and that the flow is not as deep as shown. For instance, the road-

cutting leading westward from the Fyansford Bridge gives an exposure of the tertiary strata a few feet in extent, at a height of about 40 ft. above the stream. The exposed rock is the yellow clay, with calcareous nodules, so constantly occurring near the top of the series in the neighbourhood. The only fossil we found was an oyster; but a more careful search would probably yield more forms. The tendency of the basaltic *débris* to completely mask a hill side, thus giving an erroneous view of the depth of the flow, is well shown in various places in the valley; and here, when walking along the river bank a few days before noticing the outcrop above, we had no idea that the geological boundary needed a correction. The difference in the level of the basalt on the two sides of the valley is a marked one. Standing on Orphanage Hill, far below the level of the base of the flow, one can see for miles over the basalt plain to the westward; and extensive denudation must consequently have taken place both before and after the outflow of igneous rock.

The geological quarter-sheet gives 10 ft. of loose sand underlying the basalt. This in the map is coloured yellow, indicative of Older Pliocene, and the outcrop is shown extending far up the valley. There is, however, but little doubt as before mentioned, that the deposit is of the same age throughout, and no sufficient grounds exist for dividing it into two parts. The change from clay to sand is a gradual one, which can be traced as we go up the hill on any of the sections exposed in the valley. The change in the character of the sediment naturally affected the inhabitants of the sea, but the fossils which occur in the sandy strata occur in the argillaceous beds as well, and no new forms appear.

The Orphanage Hill section is a very typical one. The grey clays at the base become yellow as they pass upwards, and calcareous nodules and bands make their appearance in the more arenaceous rock near the summit. The beds have been energetically searched for fossils by some of the Geelong collectors, and consequently good specimens are now somewhat difficult to procure. However, as a result of visits on various occasions, we have procured specimens of 192 species from the locality.

In speaking of the polyzoal rock of Western Victoria, Mr. Dennant * mentions that at Muddy Creek the limestone

* "Proc. A.A.A.S.," 1890, p. 442.

occurs at a lower level than do the gastropod beds, though the actual contact cannot be seen. In South Australia, also, Professor Tate * states that the polyzoal rock is the older of these two members of the series. The evidence we have adduced shows that in this locality as well, the sequence of the beds, as might have been expected, is similar. The deposit at Orphanage Hill, and consequently its extension up the valley of the river is usually spoken of as Oligocene, though coloured Miocene in the quarter-sheet; while the Waurn Ponds rock, which, like the Batesford limestone, is true polyzoal rock, is called miocene. This is, however, a reversal of the true sequence, for the limestone is undoubtedly the underlying member of the series. In his exhaustive examination of the Muddy Creek beds, Mr. Dennant† states that the whole series must be referred to eocene age, and the list of fossils we give, shows that no very marked difference if any at all exists between the ages of the gastropodous clays in the two localities.

Other Tertiary Deposits.

We paid but little attention to the other tertiary deposits. The basalt capping the hills is a portion of the extensive flow of our western plains. The source of the rock is not apparent at any rate in the immediate neighbourhood.

The river valley is covered in most places by drift, varying from fine sand to coarse gravel, consisting principally of quartz. Near Madden's, some greenstone pebbles were obtained, resembling those of the Barwon drift, both above and below the junction with the Moorabool. In the case of the former stream, they are probably derived from the gabbro outcrop, marked on the survey map as occurring about six miles above the junction; but the origin of the pebbles in the Moorabool is not clear. The drift is marked on the geological map as being of pliocene age.

Our thanks are due to Mr. J. Dennant, F.G.S., F.C.S., &c., for his kind assistance in the identification of many of the fossils.

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* "Trans. Roy. Soc. S. Aust.," 1884.

† "Trans. Roy. Soc. S. Aust.," 1888, and "Proc. A. A. A. S.," *loc. cit.* See also "Trans. Roy. Soc. Vict.," 1891, p. 63.

The following shows the number of specimens recorded from each of the localities dealt with in the paper:—

TABLE I.

Filter Quarries	...	...	16
Upper Quarry	...	...	14

TABLE II.

Orphanage Hill	...	...	192
Coghill's ...	...	...	106
Griffin's ...	...	...	113
Near Madden's	...	...	35
Near Viaduct	...	...	122

The whole number of species is 295, and of these the mollusca and brachiopoda amount to 264.

In comparing the latter with eocene fossils of Muddy Creek, as recorded by Mr. Dennant, we find 145 common to both deposits, and as 102 of the remainder have been only determined generically, being as yet undescribed, it will be seen that the agreement between the beds is exceedingly close.

TABLE I.

Name of Specimen.	Locality where Obtained.	
	* Filter Quarries.	Upper Quarry.
Foraminifera.		
Orbitoides mantelli	x	x
Amphistegina sp.	...	x
Operculina sp.	...	x
Gypsina sp.	...	x
Corals.		
Placotrochus deltoideus, Duncan	x	...
" elongatus, Duncan	x	...
Flabellum gambierense, Duncan	x	...
Isis sp.	x	...
Echinodermata.		
Pericosmus gigas, McCoy	x	x
" sp.	x	...
Clypeaster gippslandicus, McCoy	x	x
Monostychia australis, McCoy	x	...
Brachiopoda.		
Waldheimia garibaldiana, Davidson ...	x	x
Magasella compta, Sow	x	...
" woodsiana (?), Tate	x	...
Terebratulina davidsoni, Etheridge	...	x
Lamellibranchiata.		
Pecten murrayanus, Tate	x	x
" polymorphoides, Zittel	x	...
" subbifrons, Tate	...	x
Spondylus pseudo-radula, McCoy	...	x
Nucula sp.	...	x
Ostræa sp.	x	x
Gasteropoda (a few casts)	...	x
Pisces.		
Lamna sp.	x	...

* NOTE.—These quarries are both in the Polyzoal Rock, and are marked *Filter* Quarries (7), and Upper Quarry (8), on the plan.

TABLE II.

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Foraminifera.					
Orbitoides mantelli	...	...	x	x	...
Other genera and species ...	x	...	x	x	x
Corals.					
Placotrochus deltoideus, Duncan ...	x	x	x	...	x
,, elongatus, Duncan ...	x	x	x	...	x
Flabellum gambierense, Duncan ...	x	x	x	...	x
,, victoriæ, Duncan ...	x	x	...	x	x
Notocyathus viola, Duncan ...	...	x	x	...	...
,, australis, Duncan ...	...	x	x	...	...
,, sp.	...	...	...	x	...
Trematotrochus (?) sp.	...	...	x	...	...
Balanophyllia australiensis, Duncan	x	x	...	...	x
Other species	x	x	x	x	...
Echinodermata (indeterminate casts; also spines)	x	x	x	x	x
Crustacea	...	x	...	x	...
Polyzoa (various species)	x	x	x	x	x
Salenaria sp.	...	...	x	...	...
Brachiopoda.					
Waldheimia garibaldiana, Davidson	x	x	x	...	x
,, insolita, Tate ...	...	x	...	...	x ?
,, corioensis, McCoy ...	...	x	...	...	x
Terebratula vitreoides, T. Woods ...	x	x ?	...	...	..
Terebratulina scoulari, Tate ...	...	x ?	...	...	...
,, sp.	...	x	x	...	x
,, davidsoni, Etheridge	...	...	...	x	...
Lamellibranchiata.					
Pecten murrayanus, Tate ...	x	...	...	...	x
,, sturtianus, Tate	x	...	...	...	x
,, semilaevis, McCoy ...	...	...	...	...	x

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Lamellibranchiata—continued.					
Pecten yahlensis, T. Woods ...	...	...	...	...	x
„ zitteli, Hutton	...	...	...	...	x
„ sp.	x	...	...	2 sp. (frag.)	x
„ foulcheri, T. Woods ...	x	...	...	...	...
„ gambierensis, T. Woods ...	...	...	x	...	...
Spondylus pseudoradula, McCoy ...	x	x	x	...	x
Dimya dissimilis, Tate	x	x	...	x	x
Pectunculus m'coyii, Johnston ...	x	x	x	x	...
„ cainozoicus, T. Woods	x	...	x	...	...
Limopsis belcheri, Adams and Reeve	x	x	x	x	x
„ aurita, Brocchi ...	x	x	...	x	x
Lima bassii, T. Woods	x	...	...	...	...
„ linguliformis (?), Tate ...	x	...	...	...	...
Leda vagans, Tate	x	x	x	x	x
„ obolella, Tate	x	...	...	...	...
„ apiculata, Tate	...	x ?	...	...	x
„ sp.	x	...	...	...	x
„ sp.	...	...	...	x	...
Trigonia tubulifera, Tate ...	x	x	...	...	...
Barbatia celleporacea, Tate ...	x	...	...	...	x
Macrodon cainozoicus, Tate ...	x	...	...	x	x
Cardita gracilicostata, T. Woods ...	x	x	...	x	x
„ compacta, Tate	x	x	x	...	x
„ scabrosa (?), Tate ...	x	...	...	...	x
„ sp. nov. (?)	x	...	...	frag.	...
„ polynema, Tate	x	...	...	...	...
„ delicatula, Tate	x	x	x	...	...
„ sp.	...	...	...	...	x
Nucula tumida, T. Woods ...	x	x	x	...	...
„ morundiana, Tate ...	x	...	...	...	...
„ atkinsoni, Johnston ...	...	...	...	...	x
Chama lamellifera, T. Woods ...	x	...	x	...	x
Myodora tenuilirata, Tate ...	x	...	x	...	x
Semele vesiculosa, Tate	x	...	...	...	...
Cytherea eburnea, Tate	x	x	x	...	x
„ sp.	x	...	...	...	...
Chione sp.	x	...	x	...	x
„ sp. (nov.)	...	...	x	...	...

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Lamellibranchiata—continued.					
Chione sp.	x	...	...	...	...
Crassatella dennanti, Tate ...	x	...	x	...	x
„ astarteformis, Tate ...	x	x	x	...	x
Ostræa hyotis	x	...	...	...	x
„ sp.	x	x	...	x	x
Cardium antisemigranulatum, McCoy	x	...	...	...	...
„ sp.	x	...	...	...	...
Cucullaea corioensis, McCoy ...	x	...	x	...	...
Corbula ephamilla, Tate... ...	x	x	x	...	x
„ pixidata, Tate	x	x	x	...	x
Hinnites corioensis	...	x	...	...	x
Modiola sp.	...	...	x	...	...
Gasteropoda.					
Typhis laciniatus, Tate	...	...	x	...	...
„ sp.	x	x	...	...	x
„ m'coyii, T. Woods ...	x	...	...	...	...
„ evaricosus, Tate	...	...	x	...	...
Murex lophoessus, Tate ...	x	...	...	...	...
„ velificus, Tate	x	...	...	...	x
„ amblyceras, Tate ...	x	x	...	...	...
„ trochispira, Tate ...	x	...	...	...	...
„ camplytropis, Tate ...	x	...	...	...	...
„ eyrei, T. Woods... ..	x	...	...	...	...
„ asperulus, Tate	x	x	...	...	x
„ sp.	...	...	...	...	x
Trophon polyphyllus, T. Woods ...	x	x	...	...	...
Ranella prattii, T. Woods ...	x	x	x	...	x
Rapana aculeata, Tate	x	...	x ?	...	...
Triton cyphus, Tate	x	...	x	...	x
„ tumulosus, Tate	x	...	x	...	x
„ woodsii, Tate	x	x	x	...	x
„ gemmulatus, Tate ...	...	...	...	...	x
„ tortirostris, Tate... ...	...	...	x	...	x
„ textilis, Tate	x	...	...	...	...
„ sp.	x	...	...	...	...
Fusus dictyotis, Tate	x	...	...	...	...
„ craspedotus, Tate ...	x	x	...	...	...

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Gasteropoda—continued.					
Fusus acanthostephes, Tate ...	x	x	...	...	x
„ foliaceus, Tate	x	...	x	...	...
„ aciformis, Tate	...	...	x	...	...
„ senticosus, Tate	x	...	...	...	...
„ hexagonalis, Tate ...	x	...	...	...	...
Fasciolaria cryptoploca, Tate ...	x	...	...	...	...
„ decipiens (?), Tate ...	x	...	...	...	...
„ rugata, Tate	x	x	x	...	...
„ cristata, Tate ...	...	...	x	...	...
Peristernia subundulosa, Tate ...	x	...	...	...	x
„ lintea, Tate	...	...	x	...	...
Sipho sp.	..	x	2 sp.	...	...
„ asperulus, Tate	x	...	...	...	x
Siphonalia, sp.	x	...	...	...	...
Dennantia ino, T. Woods ...	x	...	...	...	...
„ cingulata (var.), Tate ...	x	x	x	...	...
Leucozonia sp....	...	x	...	...	...
Nassa tatei, T. Woods	x	x	x	x	x
Voluta hannafordi, McCoy ...	x	...	x	...	...
„ antiscalaris, McCoy ...	x	x	...	...	x
„ strophodon, McCoy ...	x	x	...	...	x
„ ancilloides, Tate	x	...	...	...	...
„ m'donaldi, Tate ...	x	...	...	...	...
Voluta costellifera, Tate ...	x	...	...	...	x
„ (volutoconus) conoidea, Tate	x	...	...	...	...
„ pseudolirata, Tate ...	x	...	...	...	...
„ cathedralis, Tate ...	x ?	...	...	.	...
„ sp. nov.	...	...	...	...	x
„ polita, Tate	...	...	...	...	x
„ sp.	...	...	...	...	x
Lyria harpularia (?), Tate ...	x	...	...	...	...
Mitra atractoides, Tate	x	...	...	...	...
„ alokiza, T. Woods ...	x	...	...	...	...
„ ligata, Tate	x	x	x	...	x
Marginella woodsii, Tate ...	x	x	...	..	x
„ propinqua, Tate ...	x	x	x	...	x
„ wentworthi, T. Woods	x	...	juv.	x	x
„ inermis, Tate ...	x	...	...	...	...

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Gasteropoda—continued.					
Marginella (juv.)	x	...	...	...	...
„ micula (var.), Tate ...	...	...	...	...	x
„ sp.	...	...	...	...	x
Oliva, sp.	x	...	...	...	...
Ancillaria pseudaustralis, Tate ...	x	...	x	...	...
„ sp.	x	...	...	...	...
„ sublaevis (?), T. Woods	...	x	...	..	...
Harpa sp.	x	...	...	...	...
Cancellaria varicifera, T. Woods ...	x	x	..	...	x
„ sp.	...	...	...	x	...
„ laticostata, T. Woods ...	x	...	...	..	x
Terebra platyspira, Tate ...	x	...	...	...	...
Pleurotoma haastii, Hutton ...	x	x	x	...	x
„ murndaliana, T. Woods	x	x	...	...	x
„ clarae, T. Woods ...	x	x	x	x ?	x
„ sp.	x	x	x	...	...
„	2 sp.	...	...	...	...
„	...	...	6 sp.	...	...
„	...	4 sp.	...	...	...
„	...	...	...	...	4 sp.
Drillia trevori, T. Woods ...	x	x	x		x
„ integra, T. Woods ...	x	x	x	..	x
„	6 sp.	...	...	...	...
„	...	6 sp.	...	...	...
„	...	...	2 sp.	...	...
„	...	...	...	...	1 sp.
Mangelia	7 sp.	...	..	..	...
„	...	3 sp.	...	...	...
„	...	...	4 sp.	...	...
„	...	...	...	...	5 sp.
„ bidens, T. Woods ...	x	x	x	...	x
Bela sp.	x	...	...	...	...
Conus hamiltonensis, Tate ...	x	...	...	...	...
„ (aff. pullulescens), T. Woods	...	x	...	...	...
„ sp.	x	..	...	...	...
„ ligatus, Tate	x	...	x	...	...
Cypraea eximia, McCoy	x	...	juv.	x ?	x
„ gigas, McCoy	x	frag.	x	...	frag.

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near
Gasteropoda—continued.					
Cypraea leptorhyncha, McCoy ...	x	x	...	...	x
„ contusa, McCoy ...	x	...	...	...	x ?
„ pyrulata, Tate	x	...	...	...	...
„ subsidua, Tate	x	...	...	...	...
„ subpyrulata, Tate ...	x	...	...	...	...
„ sp.	...	x	..	...	x
„ sp.	...	...	x	...	...
Trivia avellanoides, McCoy ...	x	x	x	...	x
Cassis exigua, T. Woods ...	x	...	...	...	frag.
Semicassis transenna, Tate ...	x	...	...	...	...
Cassidaria sp.	x	...	...	...	...
Natica hamiltonensis, T. Woods ...	x	x	x	...	x
„ gibbosa, Hutton	x	x	x	...	...
„ polita, T. Woods ...	x	x	x	...	x
„ auriculata, Tate, m.s. ...	x	...	...	...	...
„ (?) sp. (nov.)	...	..	...	...	x
Crepidula sp.	x	...	...	...	...
Calliostoma sp.	x	...	2 sp.	x	...
Astele sp.	...	...	...	...	x
Xenophora agglutinans, Lam. ...	x	...	...	...	x
Solarium acutum, T. Woods ...	x	...	..	...	x
Scalaria sp.	x	...	...	...	...
Turritella murrayana	x	x	x	...	...
„	4 sp.	...	...	1 sp.	...
„	...	3 sp.	...	...	...
„	...	...	4 sp.	...	...
„	...	...	...	...	3 sp.
Siliquaria squamulifera, Tate, m.s.	x	x	x	...	x
„ sp. nov.	x	...	x	...	...
Eulima danae, T. Woods ...	x	...	...	...	...
„ sp	...	x	...	...	...
Niso psila, T. Woods	x	x	x	...	x
Cerithium apheles, T. Woods ...	x	x	x	...	x
„ sp.	x	...	x	...	...
„ sp.	...	x	...	...	...
Triforis wilkinsoni, T. Woods ...	x	...	...	...	...
„	3 sp.	...	...	...	...
„	...	...	2 sp.	...	...

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Gasteropoda—continued.					
Triforis	...	...	..	...	1 sp.
Mathilda sp.	x	...	...	...	...
Liotia sp.	x	...	...	...	...
„ sp.	...	...	x	...	...
„ sp.	x	...	...	...	...
Cyclostrema (?) sp.	...	...	...	...	x
Fissurellidæa malleata, Tate ...	x	x	x	...	...
Hemitoma occlusa, Tate, m.s. ...	...	...	x	...	x
Emarginula candida, Tate, m.s. ...	x	...	...	...	...
„ sp.	x	x	...	...	...
„ sp.	x	...	...	...	...
„ cymbium (?), Tate, m.s.	...	...	...	...	x
„ sp.	...	...	x	...	...
Entalis mantelli, Zittel	x	x	x	x	x
„ annulatum, Tate ...	x	x	x	x	x
Dentalium aratum, Tate ...	x	x	x	x	x
Cylichna exigua, T. Woods ...	x	...	x	...	...
„ sp.	x	...	...	...	...
„ sp.	...	...	...	...	x
„ sp.	...	...	x	...	...
Dolichotoma sp.	x	x	x	...	x
Magilus sp.	...	...	...	...	x
Vermetus (?) sp.	x	...	x	...	x
Scaphander fragilis, Tate, m.s. ...	x	...	...	...	...
Bulla scrobiculata	x	...	...	...	...
„ sp.	...	x	...	...	x
Ringicula australis (?)	x	...	...	...	...
„ sp.	...	...	x	...	...
Pusianella hemiothone	...	x	...	..	...
„ sp.	x	...	...	...	...
„ sp.	...	...	...	...	x
Columbella cainozoica, T. Woods ...	...	x	...	...	x
Clathurella sp.	...	x	...	...	...
Daphnella gracillima, T. Woods ...	...	...	x	...	...
„ sp. (?)	...	x	...	...	...
Delphinula sp.	...	x	...	...	...
Eburnopsis sp.	...	...	x	...	...
Rissoa (?) chrysalida, Tate, m.s. ...	...	...	x	...	...

Name of Specimen.		Locality where O[...]			
		Orphanage Hill.	Coghill's.	Griffin s.	Near
Gasteropoda—continued.					
Trochocochlea (?) sp. ...	...	...	...	x	..
Cephalopoda.					
Aturia australis, McCoy	...	x	...	...	..
Nautilus sp.	..	x	...	...	..
Pisces.					
Shark's teeth (2 species)	...	x	...	...	x
Ear bones	...	...	x	x	3 s

Dog Rocks

Name of Specimen.	Locality where Obtained.				
	Orphanage Hill.	Coghill's.	Griffin's.	Near Madden's.	Near Viaduct.
Gasteropoda—continued.					
Trochocochlea (?) sp.	...	...	x	...	...
Cephalopoda.					
Aturia australis, McCoy ...	x	...	...	...	...
Nautilus sp.	x	...	...	...	...
Pisces.					
Shark's teeth (2 species) ...	x	...	...	x	...
Ear bones	...	x	x	3 sp.	x

Proc. R.S. Victoria, 1891, Plate 3

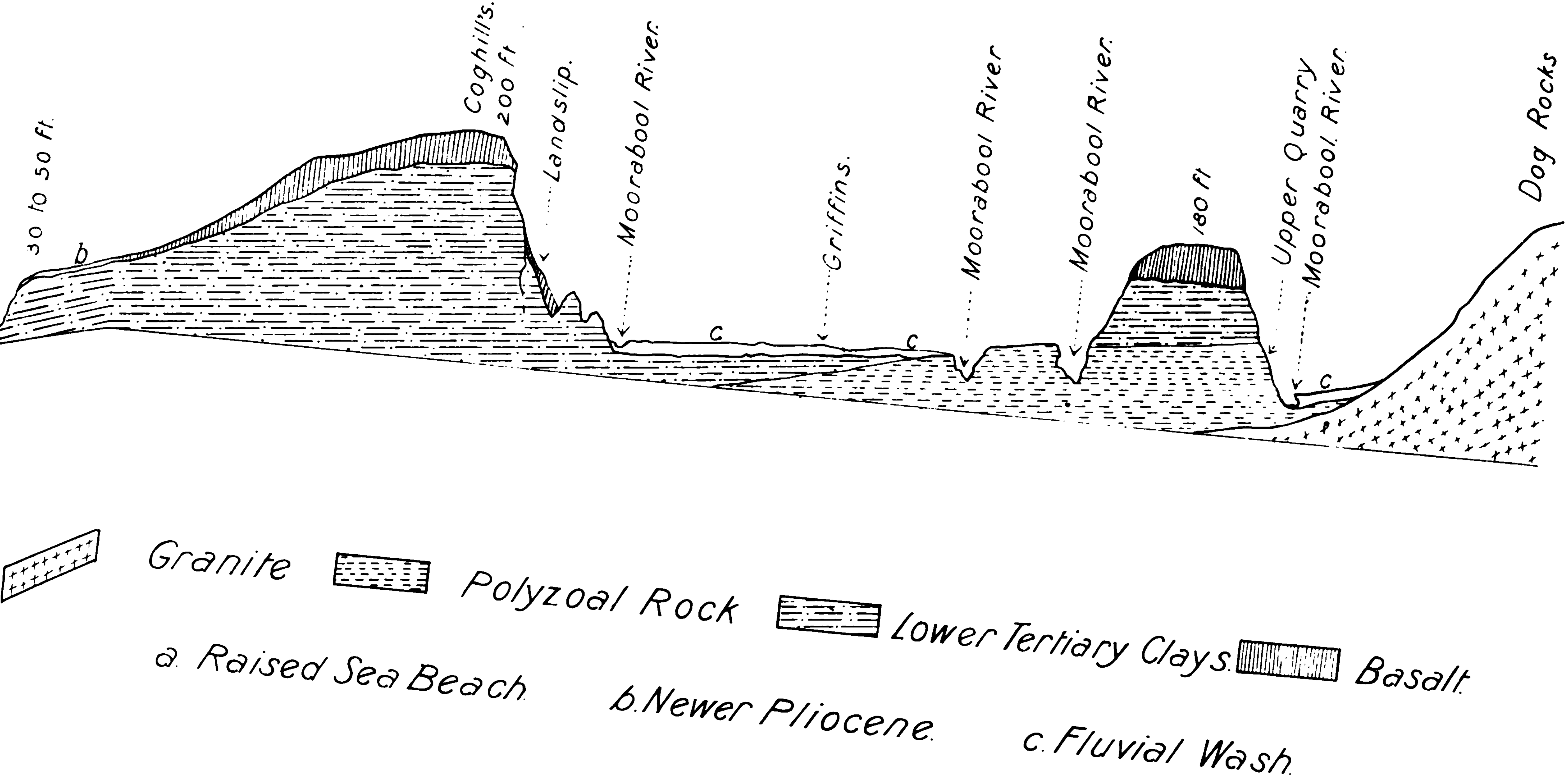
Sketch Map of the District N.W. of Geelong.

Proc. R.S. Victoria, 1891. Plate 4.

Section from Corio Bay to the Dog Rocks.

DISTANCE about 6 miles.

Horizontal scale 1¼ inch to 1 mile.



Art. IV.—*A New Species of Fresh-water Fish from Lake Nigothoruk, Mount Wellington, Victoria.*

By A. H. S. Lucas, M.A., B.Sc.

[Read June 11, 1891.]

Galaxias nigothoruk, sp. n.

D. 10. A. 11–13. P. 16. V. 7.

Height of body in front of dorsal fin contained between seven and eight times in the length exclusive of the caudal fin. Length of head contained rather more than four times in the same.

Head broad; trunk gradually narrowing to root of caudal; width between eyes equal to maximum height of head; jaws about equal; maxillæ reaching to beneath anterior third of eye; diameter of eye rather less than one-fourth length of head, quite equal to length of snout.

Dorsal commences at last third of trunk; anal a little behind dorsal; pectorals reach rather more than half way to roots of ventrals; ventrals extend over nearly two-thirds of distance between their roots and the vent. Minimum height of tail about two-thirds height of trunk between dorsal and ventral fins.

Coloration.—Ground hue of skin dark-green on back of trunk; lighter green on sides; on belly, silvery blueish-green; Ground hue of head olive-green dorsally, blueish-green ventrally, operculum purplish. Whole skin covered with innumerable tiny brown to black pigment dots. These, when crowded close together, form dark spots, which give the trunk a richly speckled appearance. On the fins, the dots are arranged along the rays. Fins reddish-yellow. Iris a beautiful bronze-yellow.

General length of those caught, somewhat over three inches. None of much greater length were observed, but of this size and smaller, there were thousands.

Locality.—Lake Nigothoruk, above the head of the Wellington River, Gippsland, the only known mountain lake in Victoria.

Food.—Insects, worms, &c.

ART. V.—*Note on the Alkaloids of Strychnos psilosperma.*

By Prof. RENNIE, M.A., D.Sc., and G. GOYDER, Jun., Esq., F.C.S.

[Read August 13, 1891.]

Some time ago, Baron von Mueller kindly forwarded to one of us, for examination, a small parcel of fruits of Strychnos psilosperma. Baron von Mueller states that this species is not yet cultivated anywhere, and that his correspondent in sub-tropical Eastern Australia had watched the few plants there, in their native haunts, for several years, but that they never bore fruit till last year.

The method used for extraction of the alkaloids was as follows:—The fruits were pounded up as far as possible, and then nearly dried in the water oven. Ten grammes of this material was then mixed with a suitable quantity of lime, some water added, and the mixture dried on a water bath. It was then placed in a Soxhlet's apparatus and extracted for several hours with strong alcohol. The alcoholic extract, having been slightly acidified with sulphuric acid and filtered, was evaporated, again filtered, rendered alkaline with soda, and thoroughly extracted with chloroform. The chloroform extract, after evaporation, was again taken up in acidified water, filtered, again rendered akaline, and extracted with chloroform. The residue, after evaporation, was then dried at 100° C. till constant. The weight of mixed alkaloids so obtained was ·031 gramme, which, allowing for about 4 per cent. of water still remaining in the nearly dried material, gives a yield of 0·32 per cent. Though every care was taken to make the extractions as thorough as possible, this result is doubtless below the truth; but allowing for experimental error, the yield of total alkaloids is not great in comparison with that obtained from some other species. Strychnos Ignatiæ, for example, yields about 1·5 per cent. of strychnine, and 0·5 per cent. of

brucine. It is quite possible, however, that under favourable conditions the yield would be much increased. The quantity of total alkaloids was so small, that a quantitative separation was not attempted. A qualitative separation, however, revealed the presence of both strychnine and brucine, the former apparently in considerable excess.

Art. VI.—*On the Oviparity of Peripatus leuckartii.*

By Arthur Dendy, D.Sc., F.L.S.

[Read August 13, 1891.]

Peripatus leuckartii has proved to be by no means uncommon in Victoria, being recorded from a good many distinct localities, and exhibiting a remarkable series of variations in colour and pattern, as I have already described.* Hitherto, however, little has been known of its habits, and nothing of its mode of reproduction. The only observer, so far as I am aware, who has said anything of its life-history, is Mr. Fletcher, who has described† four very young individuals, the progeny of a female kept by him in damp moss and leaves for four months (July to October inclusive). Mr. Fletcher did not observe the birth of the young, but found them in company with the mother when apparently only a few days old. He assumes, naturally enough, that they were born alive, as in all other species whose life-history is known ; the viviparous habit being, indeed, one of the most remarkable characters of *Peripatus.*

In May last I obtained several specimens of *Peripatus leuckartii*, chiefly from Macedon, some of which I have since kept alive in a small vivarium specially arranged for the purpose. The vivarium consists of a large glass jar, with a flat glass tcp supported on two thin slips of glass slightly above the edge of the jar, in order to admit of free ventilation. To guard against drying up, from which cause I had previously lost specimens, I keep a small open jar of water inside the larger one, and the floor of the vivarium is thickly covered with very rotten wood, kept moist by the evaporation of the water.

In this vivarium *Peripatus* flourishes well, and the specimens may be inspected, when desired, by turning over the

* "Proceedings of the Royal Society of Victoria," July 11, 1889.

† "Proceedings of the Linnean Society of New South Wales," October 31, 1888.

rotten wood. On making such an inspection on the 31st of July last, I found that some twelve or fifteen eggs* had been deposited beneath bits of rotten wood, and in crevices of the same. Careful examination showed that these were undoubtedly eggs laid by *Peripatus.* I collected all I could find and removed them, with some of the rotten wood, to a separate receptacle, and then carefully turned out the vivarium, and examined its contents. I found that there were present four specimens of *Peripatus leuckartii*, one male and three females, all apparently in good health,† and that there was nothing else which could possibly have laid the eggs, the largest living thing visible besides the *Peripatus* being a very small ant.

The vivarium was stocked on the 18th of May, and as I have carefully examined it several times since then, I am sure that the eggs must have been recently deposited. The view that they are really eggs of *Peripatus* receives strong support, if required, from anatomical examination of adult females. In these, I have nearly always found eggs in the uterus, but, although I have dissected specimens killed in December, May and July, I have never found embryos.‡ Moreover, the structure of the eggs *in utero* is very characteristic, and argues strongly against any idea of intra-uterine development. They are very large, oval in shape, and consist each of a very tough, thick membrane, enclosing a quantity of thick milky fluid full of yolk granules. I have only examined one egg microscopically after laying, as I wish as far as possible to watch the development; but this one agreed so closely with those found *in utero* that there can, I think, be no reasonable doubt of its identity. It was of just about the same size ($\frac{3}{40}$ by $\frac{3}{50}$ inch), of the same colour (very pale yellow), with a very tough membrane and a milky fluid contents containing very many yolk granules, but with no appearance of an embryo. The only difference concerns the almost chitinous-looking membrane which, instead of being smooth or nearly so, as when *in utero*, is exquisitely sculptured or embossed

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* To determine the exact number would have involved breaking up the wood and thus disturbing the eggs more than seemed desirable.

† The male has since died, but the females were all still alive and apparently healthy on August 17th.

‡ The only July specimen dissected contained neither eggs nor embryos. Possibly the eggs had been recently deposited. The specimen was captured quite at the end of the month.

in a beautiful and regular design, consisting of little crumpled papillæ, somewhat resembling worm-casts, arranged at fairly regular intervals over the surface, and with much finer meandering ridges occupying the spaces between them. Such sculpturing is, as is well known, characteristic of many insect eggs, which renders it especially interesting in view of the relationships of *Peripatus*. As it is not present in intra-uterine* eggs, it must be formed as the egg passes through the vagina, which is large and thick-walled.

It thus appears that *Peripatus leuckartii* lays eggs in July, or thereabouts; and it appears also, from Mr. Fletcher's observations, with which it will be seen that my own fit in very well so far, that the young are hatched at the end of October. As, however, I have also found large eggs in a specimen captured and killed in December, I think it not impossible that the animal may be double-brooded.

The mode of reproduction in *Peripatus leuckartii* thus seems to differ widely from that known in any other species of the genus, and to conform rather to the insect type. Probably, considering the immense quantity of food-yolk present, the development also differs widely; this I hope to be able to work out in time, but the presence of so much fluid and granular yolk, and of such a tough membrane, will, I fear, render the task very difficult.

It would be interesting to discover whether *Peripatus insignis*, the only other known Australian species, is also oviparous. The smaller size and much rarer occurrence of this species, however, will render investigation more difficult.

Postscript.—On August 31st one of the female specimens was found dead in the vivarium. I at once dissected it, and found the reproductive organs very well developed; but, although the ovary and oviducts were both large (the former containing a great many ovarian eggs), there was not a single egg in either of the oviducts. Doubtless, all the eggs had been laid. It is worth mentioning in this connection that another female specimen found at Macedon in May last (at the same time as the specimens which were placed in the vivarium) was dissected a few days after being captured, and was then found to contain no less than twelve large eggs in the oviducts.

* I have used the term "uterus" in accordance with the customary nomenclature, it would probably be better to speak only of "oviducts" in *Peripatus leuckartii*.

Up to the present time (September 4th) I have found no more eggs in the vivarium. The total number of eggs found is fourteen. This seems a small number for three females to lay, but probably the number laid varies considerably, as one specimen which I dissected some time ago contained only six eggs in the oviducts.

Art. VII.—*Short Descriptions of New Land Planarians.*

By Arthur Dendy, D.Sc., F.L.S.

[Read August 13, 1891.]

The object of the present communication, is to describe as briefly as possible some new species and varieties of land planarians which have come to hand since I read my last paper on the subject before this Society.* The specimens described were collected by Professor Spencer, Messrs. C. French, F.L.S., H. Grayson, and C. C. Brittlebank, to all of whom I wish to express my indebtedness. The most interesting of the new species is *Rhynchodemus simulans*, collected by Mr. Brittlebank at Myrniong, near Bacchus Marsh, Victoria. With the exception of the single specimen of *Rhynchodemus victoriæ* obtained by Professor Spencer in the Croajingolong district, not very far from the New South Wales border, and described by me in a previous communication,† this is the first time the genus *Rhynchodemus* has been met with in Victoria. I hope on a future occasion to be able to publish figures of all the new species and varieties.

Geoplana ventrolineata, n. sp.

Body, when crawling, almost circular in section, tapering gradually at either extremity; length about 23 mm.; greatest breadth little over 1 mm. Eyes arranged as usual, and continued for a long way down the body in the light lateral line. Peripharyngeal aperture (in spirit) at about the junction of the middle and posterior thirds of the body; genital aperture somewhat nearer to the peripharyngeal aperture than to the posterior end.

Dorsal surface very dark grey, almost black, with two very narrow lines of light greyish, one on either side of a median dark grey line of about equal width. There are two similar narrow lines of pale grey, one on either side of the body, just visible from the dorsal surface.

Ventral surface strongly marked with alternate light and dark longitudinal bands, arranged as follows:—In the middle

* "Transactions of the Royal Society of Victoria," June 11, 1891.

† "Transactions of the Royal Society of Victoria," May 8, 1890.

line a rather narrow band of light yellowish grey; on each side of this, a band of about twice the width of much darker brownish, or almost purplish, grey; outside each of these again, a rather narrow band of light yellowish grey; then a narrow dark band of brownish grey and then the light lateral line already mentioned.

Anterior extremity nearly black.

This beautiful and well marked little planarian was found in abundance by Mr. H. Grayson in Brunning's Nursery Garden, St. Kilda, Victoria, in July and August 1891. Probably it was introduced with plants from some other locality, but it is impossible to say whence. It is an interesting fact that Mr. Grayson also found a number of specimens of the blue-tipped variety of *G. cœrulea* in the same locality; the history of this variety, also probably introduced, is given in my last paper on the subject.

Geoplana dubia, n. sp.

Body shaped as in *G. hoggii* and its allies. Length, when crawling, about 50 mm.; greatest breadth, 3 mm. Eyes arranged as usual, distinct and numerous. Peripharyngeal aperture (in spirit) well behind the middle of the body, but in front of the junction of the middle and posterior thirds; genital aperture doubtful.

The ground colour of the dorsal surface is rather pale yellow, with a tinge of green, especially in the middle line. Only two stripes are present, corresponding in position and appearance to the two inner stripes of *G. hoggii*; they are broad, deep blue-green in colour, and situate one on either side of a somewhat narrower band of ground colour.

The ventral surface is pale yellow, and the anterior extremity brown.

This form closely resembles *Geoplana hoggii* without the dark outer stripes, and may be only a variety of that species (or of *G. sulphurea*). It is readily distinguishable from *G. m'mahoni* by the dark stripes being of a green colour and *much closer together*. One specimen only was obtained by Professor Spencer and Mr. C. French near Narrewarren, South Gippsland, Victoria, in July 1891.

Geoplana alba, var. *roseolineata,* nov.

This very beautiful variety resembles small specimens of the typical *G. alba*, with the addition of two narrow bright

red lines running all down the dorsal surface of the body, and dividing it longitudinally into three almost equal parts. Several specimens were obtained, the usual size of which when crawling was about 35 mm. in length, and 1·5 mm. in greatest breadth. The body was more cylindrical than in fully grown typical examples of *G. alba*.

The specimens look as if they were young. One, considerably larger than the remainder, has the red stripes less distinct. On the other hand, I have seen small specimens of *G. alba* from other localities coloured in the typical manner, without any red stripes.

All the specimens of the variety *roseolineata* were obtained along the railway line between Korumburra and Loch, South Gippsland, Victoria, by Professor Spencer, July 1891.

Geoplana howitti, var. *obsoleta*, nov.

Body tapering gradually in front, much more abruptly behind. Ventral surface very flat, dorsal surface very strongly arched. Length, when crawling, about 40 mm.; greatest breadth, about 3 mm. Opening of peripharyngeal chamber (in spirit) somewhat behind the middle of the ventral surface: genital aperture about half-way between the peripharyngeal aperture and the posterior end. Eyes sparingly arranged, almost in a single row, on the sides of the head (? round the front also).

The ground colour of the dorsal surface is rather deep primrose yellow, and there are only two, dark chestnut brown stripes, one on either side of a somewhat wider median band of clear ground colour. Outside the dark stripes the ground colour is flecked with minute specks of a lighter chestnut brown; at each side of the head these specks run together to form an almost continuous but irregular stripe for a short distance.

The ventral surface is nearly white, with no markings, and the anterior extremity is reddish brown.

This variety differs from the type of *Geoplana howitti* in the absence of the outer dark stripes. In one of the two specimens obtained the dark specks also are only faintly indicated.

Both specimens were collected by Professor Spencer and Mr. C. French near Narrewarren, South Gippsland, Victoria, July 1891.

Geoplana adæ, var. *extralineata*, nov.

I propose this name for two small specimens of *G. adæ* with chestnut brown stripes but differing from the typical form in the possession of an additional fine brown stripe on each side, a little outside the broad one. The peripharyngeal aperture (in spirit) is situate at about the middle of the ventral surface, and the genital aperture about half way between it and the posterior end.

Both specimens were collected by Professor Spencer and Mr. C. French near Narrewarren, South Gippsland, Victoria, July 1891.

Rhynchodemus simulans, n. sp.

Body oval in section, a good deal flattened when at rest, more cylindrical when crawling; tapering gradually in front to the horse-shoe shaped anterior extremity, and more abruptly behind. Eyes two, as usual in the genus, one on either side, a little way behind the anterior extremity. Length, when crawling, about 22 mm.; greatest breadth, 1·5 mm. Peripharyngeal aperture (in spirit) well behind the middle of the ventral surface, but not quite as far back as the junction of the middle and posterior thirds of the body. Genital aperture slightly nearer to the posterior extremity than to the peripharyngeal aperture.

Dorsal surface dark grey, darker in the middle line; spotted or mottled all over (in the middle line as elsewhere) with small specks of white, giving it a beautiful and characteristic marbled appearance under a low power of the microscope.

Ventral surface marbled like the dorsal, but with the white predominating instead of the grey. Anterior extremity greyish.

A good many specimens of this beautiful little species were obtained by Mr. C. C. Brittlebank at Myrniong, near Bacchus Marsh, Victoria, in July and August 1891. It is an extremely small species and, owing to the quantity of black pigment present, I had considerable trouble in determining the number of the eyes, so that at one time I considered it as belonging to the genus *Geoplana*. Serial sections, cut by the paraffin method, however, at once decided the question in favour of *Rhynchodemus*.

ART. VIII.—*On the Presence of Ciliated Pits in Australian Land Planarians.*

(With Plate V.)

By ARTHUR DENDY, D.Sc., F.L.S.

[Read September 10, 1891.]

In his well known memoir, "On the Anatomy and Histology of the Land Planarians of Ceylon," * Professor Moseley describes the presence of ciliated pits on the anterior margin of the head of *Bipalium*. As his remarks on these pits are short, and at the same time of great interest, I may perhaps be allowed to quote them in full:—"In describing the habits of *Bipalium*, I described the manner in which the animal throws out tentacular-like projections from the anterior margin of its semi-lunar head when in motion, and evidently uses these temporary tentacles as sense organs. In reading M. Humbert's interesting account of *Bipalium*, I found that he had observed this habit of the animal as well as I, and had been led by his observation to seek for sense-organs or tentacular structures on the margin of the head. He was not successful in finding any; but on very careful examination of well-hardened specimens I was more fortunate, and discovered a narrow band extending along the whole anterior margin of the head, entirely free from pigment, and occupied by a row of cylindrical rounded papillæ placed vertically side by side, and with small oval openings between their superior extremities (Plate XIII, Fig. 16). This row of papillæ is in the upper part of the lower fifth of the margin of the head, so that it lies close to the ground when the animal's head is lowered. The papillæ are covered with short cilia, but I could find no special structure in them, except that in their region, and that of the ciliated pits, there

* Philosophical Transactions of the Royal Society, 1874.

is a large quantity of tissue formed of small spindle-cells. The oval apertures between the papillæ lead to ciliated pits, the appearance presented by which is shown in Figs. 11, 12, and 13, Plate XV. In longitudinal and horizontal sections, the appearance presented in Fig. 13 is seen. The light bands, which appear to pass to the bottoms of the ciliated pits, are continuous with the vascular* network of the head. Whether they represent tubes in communication here with the exterior, I cannot say. They may convey nerves to the sacs. From the manner in which the animal uses the front of its head, their can be little doubt that the papillary line discharges some special sense-function; but it is possible that this function is discharged by the papillæ, whilst the ciliated pits, with their communicating vascular stems act as excretory organs. The papillary line, with its pits, was found in all the species of *Bipalium* examined. The ciliated sacs of Nemertines came at once, of course, into one's mind in conection with these curious structures. Careful examination may perhaps give evidence of the existence of similar ciliated sacs in *Geoplana* and other Planarians. Nothing of the kind was found in *Rhynchodemus*."

Although Professor Moseley subsequently studied and described† species of *Geoplana* from New South Wales and elsewhere, he failed to discover the presence in them of ciliated pits. Von Kennel, also, makes no mention of them in the German land Planarians belonging to the genera *Rhynchodemus* and *Geodesmus*, which were carefully investigated by him,‡ nor have they hitherto been discovered by any of the Australian zoologists who have more recently paid attention to the group. In my memoir on "The Anatomy of an Australian Land Planarian," published in the Transactions of this Society for 1889, no mention is made of any such organs, nor did I at that time suspect their existence, so that, so far, the memoir is incomplete, and I am glad of the present opportunity of making up the deficiency.

The object of the present communication, therefore, is to record the occurrence and describe the structure and arrangement of ciliated pits in Australian land Planarians belonging to the genera *Geoplana* and *Rhynchodemus*. It

* This is now known to be a nervous, and not a vascular, structure.—A. D.

† "Notes on the Structure of Several Forms of Land Planarians, &c." *Quarterly Journal of Microscopical Science*, Vol. XVII (N.S.), p. 273.

‡ "Die in Deutschland gefundenen Landplanarien, &c." Arbeiten des Zool.—Zoot. Institut in Würzburg, Band V, Heft 2.

seems strange that these have not been discovered before, but they are of extremely minute size, invisible with a pocket lens, while even under a low power of the microscope their true nature is difficult to make out; when, however, they are examined under certain favourable conditions, which will be described presently, they are very clearly visible indeed.

The following is a list of the species in which I have found them:—*Geoplana spenceri*, *G. alba*, *G. ventrolineata*, *G. munda*, *G. ventropunctata*. *G. quinquelineata*, *G. hoggii*, *G. adæ*, *G. cæerulea* (blue-tipped variety), *G. dendyi*, *G. quadrangulata* var. *wellingtoni*, *G. sugdeni*, *G. fletcheri*, *G. howitti* var. *obsoleta*, *G. mediolineata*, *G. m'mahoni*, and *Rhynchodemus simulans*.

Of these species I have examined the ciliated pits in the living state only in *Geoplana ventrolineata*, *G. alba* and *G. cœrulea* (blue-tipped variety). In the other species I have clearly recognised them in spirit-preserved specimens. In short, I believe that the ciliated pits occur in all species of *Geoplana* and *Rhynchodemus*.

I first noticed the pits in examining some spirit-preserved specimens of *Geoplana ventrolineata* as opaque objects under a low power of the microscope. I found on the ventral surface, at each side of the anterior extremity, a light longitudinal line, devoid of pigment, slightly curved as shown in Fig. 6, and apparently slightly raised as a ridge, but this raised effect was doubtless exaggerated by the disposition of the pigment, for hardly any ridge is visible in transverse sections (Fig. 7). This line lies beneath the line of eyes, and obviously corresponds to the margin of the horse-shoe-shaped anterior extremity in the living animal. Along the inner margin of the light line on each side was visible a single row of very minute dark specks, which proved on careful examination to be minute punctuations like those made by the point of a very fine needle. These punctuations are arranged with great regularity, and extend throughout the entire length of the light line, disappearing as the latter dies out posteriorly. I could not determine whether or not the punctuations were continued all round the anterior margin; they are only clearly visible in a good light, and it is possible that I may have overlooked them in front.

Having satisfied myself as to the presence of the line of pits in *G. ventrolineata* I went through my collection and examined all the other species I had under similar conditions.

In nearly every species I saw the row of pits clearly; always situate in a light line on each side of the ventral aspect of the head, beneath the line of eyes. Generally the pits have the form of well-defined though minute perforations, as in *G. ventrolineata.* In some of the species, however, and notably in *G. spenceri* (Fig. 8) the light line (= margin of horse-shoe-shaped anterior extremity) tends to become grooved or furrowed transversely; the pits in this case lie in the transverse grooves, very much as figured by Moseley for *Bipalium.* In *G. spenceri* the transverse furrows are well marked in large specimens and may be connected by a longitudinal furrow as shown in Fig. 8. Such furrows might easily be mistaken for artificial wrinkling due to the action of the spirit, and, had it not been for comparison with other specimens, I should not have suspected the presence of ciliated pits in *G. spenceri.*

At this stage in the investigation I received from Mr. H. Grayson living specimens of *G. cœrulea* (blue-tipped variety), *G. alba* and *G. ventrolineata,* captured in Brunning's Nursery Garden at St. Kilda. Microscopic examination of these soon showed the true nature of the pits seen in spirit-preserved specimens. In making such an examination of living material I find it best to proceed as follows:—Cut off the anterior end of the Planarian with a sharp scalpel; lay it in a drop of water on a glass slip with the ventral surface uppermost; put a cover glass over it and then, with a few sharp raps on the cover glass with a pencil or other blunt instrument, flatten out and crush the specimen until it becomes sufficiently transparent. On examining such a preparation of the blue-tipped variety of *G. cœrulea* with a low power of the microscope (Zeiss A, oc. 2), and by transmitted light, I saw the appearance represented in Fig. 1. The eyes (*e.*) were arranged in single series all round the anterior extremity. Inside the line of eyes and separated from it by a narrow interval was visible the light line (*l. l.*) corresponding to the margin of the horse-shoe-shaped anterior extremity of the living animal. In this line was visible the single row of ciliated pits (*c. p.*), apparently not continuous round the front, though on this point I am doubtful. Of these pits there seemed to be about thirty on each side. A much higher power, such as Zeiss D or F, is necessary in order to make out the structure of the pits, which measure only about 0·017 mm. in outside transverse diameter.

Under a high power the pits are seen to be oval or circular in optical transverse section, with a very characteristic sharp double outline (Figs. 3 and 5), the thick wall of the pit being composed of almost cubical cells arranged in a circle. These cells in *G. cœrulea* are slightly granular, and richly ciliated, resembling, in fact, the ordinary epidermic cells of the ventral surface as described by me in *Geoplana spenceri.** In *G. cœrulea* the cilia appear, as far as can be seen by focussing at different levels, to be continuous right to the bottom of the pit, while the pits themselves appear deep and dilated below. The cilia in the pits work in a spiral or vortex. The whole ventral surface of the animal, of course, also appeared ciliated. Occasionally the wall of the pit is seen to contract suddenly and spasmodically, but this only happens rarely and with no regularity.

The observations made upon living specimens of *Geoplana cœrulea* were confirmed in the case of *G. alba* and *G. ventrolineata.* In *G. alba* the pits are very difficult to see in spirit-preserved specimens, but they are plainly enough visible in the living animal. Fig. 5 shows a ciliated pit of *G. alba* seen in optical transverse section at the lowest focus. The cells of the wall seem to be less granular than in *G. cœrulea*, and the cilia do not seem to extend quite to the bottom of the pit, which appears to be occupied by a granular substance. The wall of the pit sometimes twitched spasmodically. In this species the pits are continued right round the anterior margin, and in my preparation the most anterior of them lay right on the edge, so that I was able to study them in optical longitudinal section also. Such a section is represented in Fig. 4. It will be seen that the outer part of the pit is funnel-shaped, that it is narrowest in the middle and dilated at its lower end. The cilia are largest around the external opening, and apparently absent from the dilatation at the bottom of the pit. The cells lining the lower portion of the pit could not be made out, it being necessary to focus through a considerable thickness of granular tissue.

In *G. ventrolineata* the ciliated pits have the same appearance in optical transverse section as in *G. alba.*

I next wished, if possible, to verify the observations recorded above by means of sections. For this purpose I selected a specimen of *G. ventrolineata*, in which the pits

* "Anatomy of an Australian Land Planarian."

were plainly visible after preservation in spirit (Fig. 6), and, after staining with borax carmine, cut a series of thin transverse sections across the anterior extremity by the ordinary paraffin method. I may state that, in order to ensure success, the sections must be cut as thin as possible. One of these sections is represented in Fig. 7 (the muscles, connective tissue, &c., are omitted in the figure; the nervous system, eyes, and epidermis only being shown). The light lines, in which the pits lie, are plainly recognisable in transverse sections by the comparative clearness and freedom from pigment of the epidermis and the tissues immediately below it. The epidermis also seems to be composed of shorter cells, richly ciliated. The exact position of the lines is shown in the figure (Fig. 7, *l. l.*). The pits themselves are more difficult to recognise, but the outer part of the pit is sometimes visible (provided the section be thin enough) as a depression in the epidermis, situate near the inner side of the light area (Fig. 7, *c. p.*); while sometimes the deeper part of the pit is also clearly recognisable, though not nearly so plainly as in the living animal. Sometimes, owing either to obliquity in the section or in the direction of the pit, the inner portion of the latter is cut transversely at a little distance below the epidermis. Special nerves run out from the cerebral ganglion to the light line on each side (Fig. 7, *n.*), and these doubtless supply the ciliated pits. The eyes, on the other hand, lie directly on, in fact partly imbedded in, the nerve sheath, and are apparently innervated therefrom (Fig. 7). The nerves, as usual in land planarians, appear as lighter, more transparent bands, surrounded by the more deeply staining tissues.

So far I have only described the ciliated pits as they appear in species of *Geoplana*. The only species of *Rhynchodemus* in which I have studied them is *R. simulans*, and only in spirit-preserved material. They are arranged exactly as in *Geoplana* around the margin of the horse-shoe-shaped anterior extremity, below the eyes, and a minute study of carefully prepared transverse sections, combined with microscopical examination of the anterior extremity as a whole, has failed to reveal any points of difference between the two genera in this respect.

It is impossible to be certain as to the function performed by the ciliated pits. Their position on the horse-shoe-shaped anterior margin, which, it will be remembered, is uplifted when the animal crawls, and their special innervation, indicate

that they are sense organs, and for my own part I am inclined to regard them as olfactory. They probably occur in all land Planarians, and it is not unlikely that they are homologous with the cephalic pits of Nemertines, as suggested by Professor Moseley.

DESCRIPTION OF PLATE V.

(Figures 1 to 5 were drawn from living specimens.)

FIG. 1.—*Geoplana cærulea* (blue-tipped variety). Anterior extremity crushed flat and examined under Zeiss A, oc. 2, as a transparent object.

e.—Eye.
c. p.—Ciliated pit.
l. l.—Light line in which the ciliated pits lie.

FIG. 2.—*Geoplana cærulea* (blue-tipped variety). Portion of the above more highly magnified. Lettering as before. The blue specks represent the pigment cells.

FIG. 3.—*Geoplana cærulea* (blue-tipped variety). Optical transverse section of ciliated pit, surrounded by pigment cells.

FIG. 4.—*Geoplana alba.* Optical longitudinal section of a ciliated pit from the extreme anterior margin (Zeiss F, oc. 2).

ep.—Epidermis.
d.—Dilatation at the bottom of the pit.
ci.—Cilia.

FIG. 5.—*Geoplana alba.* Optical transverse section of a ciliated pit; bottom focus.

FIG. 6.—*Geoplana ventrolineata.* Enlarged view of the ventral surface of the anterior extremity of a spirit-preserved specimen (Zeiss A, oc. 2); showing the light lines and ciliated pits. The eyes are not seen, owing to the opacity of the surrounding tissues.

c. p.—Line of ciliated pits.

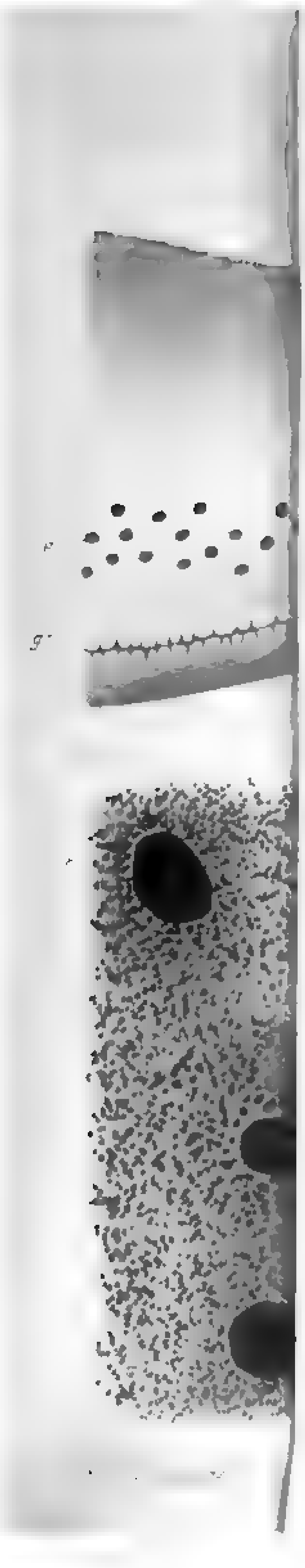
FIG. 7.—*Geoplana ventrolineata.* Transverse section of the specimen represented in the last figure. The nervous system is coloured blue (Zeiss A, oc. 4, camera outline).

c. g.—Cerebral ganglion.
n. s.—Nerve sheath.
n.—Nerve to light line and ciliated pits.

Other lettering as in previous figures.

FIG. 8.—*Geoplana spenceri.* Enlarged view of the side of the anterior extremity of a spirit specimen (Zeiss A, oc. 2), showing the eyes and the grooves in which the pits lie.

e.—Eyes.
gr.—Grooves.



ART. IX.—*Photographic Charting of the Heavens.*

By R. L. J. ELLERY, C.M.G., F.R.S., F.R.A.S.

Government Astronomer, Melbourne.

[Read July 9, 1891.]

The immense help to astronomy promised by photography, was fully recognised in the earliest days of the practical application of the art, and no sooner had Arago explained to the French Academy of Sciences Daguerre's discoveries in August 1839, than Dr. J. W. Draper, of New York, applied them to astronomical purposes, and the following year presented to the New York Lyceum of Natural Sciences, the first astronomical photograph ever taken, in the shape of a Daguerreotype picture of the moon, which was one inch in diameter, and required an exposure of twenty minutes duration. Dr. Draper and others followed up this early experiment, but the low sensitiveness of the plates then in use, and other difficulties, confined the results to the category of somewhat unsatisfactory experiment for several years. We find some sun pictures were obtained in Paris in 1845, and in the same year, pictures of the stars Vega and Castor were secured by Bond of Cambridge, U.S., and of the moon by the same astronomer in 1850. These experiments, although far from satisfactory, indicated great possibilities, supposing improvements in the art took place. Warren de la Rue, in 1851, made the first substantial advance, which was rendered possible by the discovery of the collodion process. From this time onwards, astronomical photography made steady progress, and gave most valuable assistance in the total eclipses since 1854, and on the occasions of the transits of Venus in 1874 and 1882. For the purpose of recording the apparition, development, and duration of sun spots, photography has given invaluable help, and since 1858, pictures of the sun have been obtained every fine day, first in England only, but latterly in many parts of the world, Photographs of the moon, of exquisite delicacy, are now common, and almost a commercial commodity.

Photographs of the planets and stars have hitherto been obtained unsatisfactorily, and with considerable difficulty, on account of their small amount of light compared with the sun or the moon. With the sun the light is so intense, that the difficulty is to obtain an exposure sufficiently short to avoid destroying the sensitive surface, and with the moon even a second or two is enough for telescopes of moderate dimensions. The apparent motion of these bodies in that space of time, is also so small as to require no very special contrivances to compensate for it. With stars and planets, however, where the light is but an insignificant fraction of even that of the moon, the time of exposure has to be so much prolonged, that the earth's diurnal motion renders good photographs quite impossible without the most delicate mechanical means for keeping the telescope pointed precisely and without the least deviation, on the star or planet for many minutes, or even hours. For this reason, although many efforts and experiments have been made in this direction, it is only comparatively recently that the great difficulties presented have been so far overcome as to bring this department of astronomical photography within the realms of practical work. The first important step towards this end, was the invention of the gelatine bromide plate, with its wonderfully sensitive film, reducing many times the period of exposure required for the old collodion plates ; and secondly, the devising of driving clocks for equatorial telescopes, with automatic controlling appliances, so accurately constructed that the telescope follows the motion of a star so precisely, that a plate exposed on a group of stars for an hour, will show each star as a distinct and round black spot, of a size proportional to the star's brightness, instead of a *black line*, which would result if the motion of the telescope did not exactly correspond with the motion of the earth; and fainter stars, quite invisible to the naked eye, either in the sky or on the plate, are seen under the microscope as minute and absolutely round black spots, showing unmistakably the accuracy of the movement of the telescope. These two improvements have made it possible to extend the use of photography to one of the most important branches of astronomy, that of cataloguing and charting the stars.

Immediately after the introduction of the gelatine films in 1883, we tried to get some star photographs with our great telescope, with only partial success, owing chiefly, I

believe, to the difficulty of getting the necessary smooth and uniform motion of the telescope. Still, some of the photographs, viewed in the light of our present experience, are of high promise and encourage further experiments. Some prints from these photographs are on the table. These were taken with some of the early gelatine plates made by Edwards in London. A photograph print of the group *Kappa Crucis*, will be found interesting to compare with a print obtained from a photograph of the same object taken with the astrographic telescope.

The first photograph of a nebula taken in the Southern Hemisphere, was obtained with the great Melbourne telescope in February 1883.

Star photography reached the stage of practical success in the hands of the brothers Henry, of Paris, in 1885. The Paris Observatory had been for a long time engaged in preparing elaborate charts of the heavens by the ordinary methods of eye observation, but on coming to the regions covered by the milky way, it became evident that by such a method the work would extend over an impracticably long period; they therefore decided to try the photographic method, and after numerous experiments, both with respect to optical and mechanical means, as well as photographic processes, they constructed a special instrument with which they succeeded beyond their most sanguine expectations. The photographs depicted a great number of stars not visible in a telescope of the same dimensions, and it was soon found that the number of stars impressed on the plate for any particular region, increased almost *ad infinitum* with the time of exposure of the plates. Some very important discoveries of celestial objects at once resulted, many interesting physical facts were revealed, and a new and powerful method of astronomical research established, which opens up an immense range of possibilities.

The Henrys' instrument was a double telescope equatorially mounted, one telescope to be used as a guider, and the other as the photographic camera, both rigidly connected and moving together. The whole was made to follow the diurnal motion of the earth by clock work mechanism in the usual manner, the exception being that this part of the instrument was fitted for more accurate and uniform motion than is ordinarily the case. The photographic object glass was 13·4 inches in diameter, and 13 feet focal length, while the guider telescope had an object glass of less diameter, but

about equivalent focal length. This latter telescope is used to keep the instrument pointed always exactly on the same point in the sky, by watching a selected star, which is bisected by the spider web cross in the field of the telescope, and by requisite adjusting motion, kept exactly bisected during the whole time of exposure. A photograph of the Pleiades, obtained by the brothers Henry, exhibited 1421 stars, and a small nebula around one of them, which had never before been seen or suspected. A chart of this group, which had occupied an observer three years and four months, contains 671 stars, so that one hour's photography gave the position of 1421 stars, against 671 in three years and four months by eye observation.

So remarkable a success encouraged the Director of the Paris Observatory, Admiral Mouchez, to address a circular to astronomers all over the world, suggesting that a complete charting of the heavens should be undertaken, as an international work, by the various national observatories. The proposal being favourably received, an invitation was issued to all astronomers to attend a conference on the proposal, to meet in Paris in April 1887. Fifty-eight astronomers attended this congress, Australia being represented by my colleague, Mr. Russell, of Sydney Observatory. The congress agreed to the main propositions and passed a series of resolutions on most of the vital points, leaving the further consideration of details to several selected committees. Several meetings of members of the congress have since been held, the last being in March of the present year, when nearly all the minor points left to the committees were settled, and Admiral Mouchez declared the work of the international astrographic charting of the heavens had now commenced.

The earlier resolutions fixed the dimensions and optical characters of the photographic telescopes, the size and kind of photographic plates, times of exposure, and magnitudes of the stars to be secured on the plates. Subsequent decisions allotted particular portions of the heavens to each participating observatory, numbers of plates to be exposed to each two square degrees of the skies, and so on. Questions concerning the after measurements of plates and final formation of charts and catalogues remain still to be disposed of.

The summation of the work of the congress is briefly as follows:—It was agreed to undertake a photo. chart of the heavens of all stars down to the 14th magnitude, as they

will be in the year 1900. Each participating observatory is to provide itself with a twin telescope, equatorially mounted, one for photograph camera, having an aperture of 33 centimetres (13·4 inches), and a focal length of 3·5 centimetres (13 feet), the other of about the same focal length, but of less aperture. The photographic object glasses were to be specially constructed with curves calculated for the wave lengths near the Fraunhofer line G. The exact form and dimensions of the twin guide telescope were left to the several observers participating. Gelatine bromide plates, 6¼ (166 millimetres) square to be used (particular make, left also to observers). These plates cover a little over two degrees square at the equator. Two sets of plates to be exposed, one for the catalogue to secure all stars down to the 11th magnitude, the other for the chart to contain all stars down to the 14th magnitude. Each set of plates to consist of two series, one to cover every successive 4 square degrees, and the other to cover the junction of four contiguous plates in such a way that its four corners correspond with the centres of these four contiguous plates. Eighteen observatories take part in the undertaking—eleven in the Northern, and seven in the Southern Hemisphere. For division of the work among these, the sky is partitioned into zones, and certain zones given to each observatory in such a way that no observatory will have to work very far from the zenith. Melbourne has the greatest range in this respect, as the zones from 65 degrees south to the pole are allotted to our Observatory, which gives us a zenith distance of 52 degrees. This was unavoidable, as Melbourne is the most southern of the very few observatories in the Southern Hemisphere. For every plate in each zone, a guide star has to be previously selected, and it was decided by the congress committee that such guide star must be within 22 min. of arc from the centre of the plate to which it belongs. This guide star is used as already described, and its position has to be exactly determined by transit observation to establish a date point to which all stars in the photograph have to be referred in the final measurements. The determination of these guide stars is in itself a great work, for although the position of a considerable number have already been well determined, and are to be found in existing catalogues, especially in the Northern Hemisphere, there are still a very large number of plates for which guide stars have to be found, and positions determined. To cover the whole of the

sky with two sets of plates, will require nearly 42,000 plates; the Melbourne zones will require 2298.

It has been found that the gelatine films of the plates sometimes shrink unequally in drying after development. Such a thing would of course vitiate the subsequent measurements of the stars' positions as shown on the plates. To obviate this, the following plan has been adopted:—A glass plate exactly the same size as the photographic plate, $6\frac{1}{2}$ x $6\frac{1}{2}$, is silvered on one side. This silvered surface is ruled into squares by extremely fine lines, five millimetres apart; the lines show as clear glass, and allow light to pass through. Each photographic plate before being used is placed in contact with this ruled plate and exposed for a second or two to parallel rays of light, which, passing through the rulings, impress a latent image on the film, and when developed after exposure to the stars in the telescope, exhibits the stars on a plate traversed by a network of extremely fine lines. If, now these lines are exactly five millimetres apart after the film has dried, it shows that there has been no distortion in shrinkage; if not, the amount of shrinkage can be measured. The silvered and ruled plate is called "the reseau," and every plate, before being used for charting, has to be exposed to the reseau as described.

Having explained the general scheme, I propose now to give a brief description of the arrangements made at our Observatory for the Melbourne portion of the work. The congress left it to the several astronomers to get their telescopes constructed on any plan and by any maker they chose, stipulating only that the photograph telescopes should all be of the same optical character and dimensions, viz., thirty-three centimetres aperture, and thirteen feet focal length, and the object glass to be corrected for the wave length about G. Several instruments were made in Paris, some in Germany, and some in America. Those for British and Australian observatories were made by Sir Howard Grubb, of Dublin, and ours is one of these. It consists of a twin telescope on a massive equatorial stand of the German form, with an unusually long declination axis to allow of plenty of room about the eye end when the telescope is pointed to the meridian Both the photograph and guider telescopes are made with strong steel tubes connected one with another in a most rigid manner. The photographic telescope is provided with a metallic plate holder, having all necessary

adjustments, and with a shutter to cover the object glass, which can be worked easily from the eye end. The guider telescope has an object glass of ten inches opening, and thirteen feet focal length, and is fitted with a micrometer, with long range slides and an electric lamp apparatus for illuminating the spider webs in the eye piece, and for illuminating the various setting circles, scales, &c. Every means for setting, clamping and moving are found within convenient reach of the hands, when the eye is at the guider telescope. The whole of the moving parts, which amount to nearly two tons, are so balanced and counterpoised as to be operated with the greatest ease, and kept in rotation by the clock work with wonderful smoothness and precision. Nearly everything depends on the precision with which the clock moves the telescope, so as to keep the stars apparently stationary in the field of view. For this purpose, Sir H. Grubb has devised a very beautiful arrangement, which, however, is very difficult to describe without models. The mechanism consists first of a powerful clock gear, driven by a heavy weight and controlled by a peculiar kind of governor. This clock work alone drives the telescope, so as to follow diurnal rotation very closely. and will keep a star for an hour together in the field of view of the telescope, but does not control it so accurately as to keep a star bisected on a single spider line in the eye piece of the guider. To secure this, the maker has made a special electric controlling apparatus, which may be thus described:—The driving clock being adjusted to go as accurately as possible, one of the astronomical clocks in the Observatory is made to send a momentary galvanic current every second to an apparatus attached to the driving clock, called the detector. This is a wheel driven by the clock rotating in forty seconds, having three series of contact teeth on its periphery; pressing on these teeth are three springs electrically connected with another apparatus called a "distributor," which consists of three pairs of electro magnets operating a lever capable of moving right or left and making contact with platinum points, or of being held in a central position by the central electro magnet. The action is this:—The driving clock is set going, and the astronomical clock made to send its momentary currents every second through the detector to one or other of its three springs; if through No. 1, the distributor instantaneously moves to the left platinum point; if through No. 3, to the right, and if through No. 2 to the

central electro magnet, keeping the lever neutral. Now, if the driving clock moves the telescope accurately, the astronomical clock current arrives at the moment the detector is making contact with the central spring No. 2, and the distributor remains neutral; if, however, the driving clock goes a little too fast, the current passes through No. 1 spring, and the distributor makes contact with the left platinum point, and if it goes too slow, the current passes through No. 3 spring and moves the distributor to the right platinum point. This works so well, that if the telescope moves $\frac{1}{40}$ of a second too fast, or too slow, it is immediately detected, and works the distributor. Now the "distributor" distributes another battery current to a little mechanism called an *accelerator and retarder*, whose offices are respectively to accelerate or retard the driving clock by very small amounts, according to the operation of the distributor, which is *instructed*, if one may use the word, by the detector. By this means the telescope can be kept following the stars so accurately that any one bisected by the micrometer spider web, will remain there for an hour or more together. The accelerator and retarder apparatus is composed of a pair of accurately constructed epicyclical trains, which cannot be described without models or complicated drawings. Besides these regulators, which are automatically worked as described, there is another pair workable by a hand key with two studs, and battery, so that by pressing one stud it operates the retarder and the other the accelerator.

The following will give a fair idea of the actual work of photographic charting:—The particular parts of the zones to be photographed on a night are arranged beforehand, and the guide stars for each plate selected. The dome being opened up and driving clock set going, the observer sets the instrument on the guide star, and as soon as the telescope is found to be steadily following, an assistant brings the plate holder armed with a photographic plate and inserts it into the plate holder frame of the telescope. The time of exposure being previously settled upon, the observer as soon as all goes quite steadily, opens the exposing shutter, keeping his eye constantly on the guide star, which is now bisected at the cross of the spider webs. The time of opening the shutter is noted, and at the expiration of the fixed time of exposure, as shown by an astronomical clock in the observing room, the assistant warns the observer,

who instantly closes the shutter. During the whole time, ten, twenty, forty or sixty minutes' exposure, the observer has to rigorously watch the star and spider webs, and check, by means of the accelerator and retarder hand key, any tendency to leave the intersection, and absolutely to keep the intersection bisecting the star during the whole exposure. Any failure in this respect results in the photographic images of the stars being elongated or oval, instead of round, making them difficult for measurement. One plate being thus exposed it is removed, and the instrument set on the next guide star, and so on. All changing of plates has of course to be done in the dark room, and the observing room itself must be kept moderately dark during the exposure. The development of the plates with us is usually done on the following day.

So far as the Melbourne Observatory is concerned, none of the regular charting has been commenced yet, although for four months past we have been busily engaged in necessary preliminary and experimental work. It was not until the end of March that the Central Congress definitely decided many of the principal questions, and the final instructions have not reached us even yet, nor indeed have the Reseaux, &c., and the appliances for their use. Nevertheless, there are so many preliminary difficulties to be surmounted, and so much to learn regarding the effects of varying atmospheric conditions on the photographic process, and especially as regards time of exposure, that there has been no time actually lost yet. The work will occupy several years—five at least, and probably more. Concerning the more purely photographic part of the work, the relation of magnitudes of the stars to the size of their photographic images on the plates, and the effect of fluctuating conditions of the atmosphere, I hope to be able on some future occasion to contribute some interesting facts.

ART. X.—*On a New Species of Graptolitidæ (Temnograptus magnificus).*

(With Plate VI.)

By G. B. PRITCHARD.

[Read Sept. 10, 1891.]

This graptolite came from the same locality, namely about five miles to the north-east of Lancefield, as *Dictyonema grande*, a new species described by Mr. T. S. Hall, M.A., at the beginning of this year. It was on the occasion of my second visit to this locality that I had the good fortune to procure an almost perfect specimen. This, however, was not the first collected, as on the previous trip, Mr. T. S. Hall obtained two slabs of slate showing the centre of the stock, and a few bifurcations of the stipes, also numerous smaller fragments apparently referable to the same species.

GENUS TEMNOGRAPTUS (Nicholson).

Order—*Hydrozoa.* Sub-order—*Graptolitidæ.* Family—*Dichograptidæ* (Lapworth). Zittel gives the following terse definition of this genus:—"Like *Tetragraptus*, but the four chief branches repeatedly forked in a dichotomous manner—*T. multiplex*, Nicholson."

T. MAGNIFICUS, sp. nov.

Polyp-stock multibrachiate, consisting of numerous strong bifurcating stipes which are symmetrically arranged on the two sides of their origin. Funicle very short, length 1·5 mm., breadth 1 mm., sicula not visible. Both extremities of the funicle divide into two non-celluliferous stipes, which diverge at an angle of 90°, and vary in length from about

1·55 cm. to 5·7 cm.; each of these four stipes bifurcates at an angle of about 70°, and then extends for a length varying from 3·8 cm. to 8·85 cm., when a fourth bifurcation (the first being where the funicle is given off from the sicula) takes place at about 45°. The two following bifurcations take place at smaller angles. The intermediate stipes become somewhat curved, probably owing to their flexuous nature, and vary very much in length in the same individual. The stipes after the last bifurcation are very much the longest, nearly all of them in one specimen being upwards of 20 cm. in length, and even then not showing any terminations. In the same specimen, two stipes seem to terminate at 16·4 cm. and 19 cm. respectively, and two others at 23·4 cm., though one of the latter is somewhat indistinct, owing to the jointing of the rock. No hydrothecæ are discernible until after the fifth bifurcation. The breadth of the stock in the specimen as shown in Fig. 1, on a much reduced scale, is 75·75 cm., but as the growth was probably equal on both sides of the centre, we would have the breadth of the entire stock as not less than 100 cm. The stipes are monoprionidian and, where the hydrothecæ are well developed, are 2 mm. broad; the stipes which do not show any hydrothecæ are also about the same width; these measurements may be slightly in excess as they are made from much compressed specimens. The solid axis is plainly visible in the type specimen; and there is no appearance whatever of a central corneous disc. The hydrothecæ are acute, indent the branches for about one-third the width, and are free for a little less than half their length; the upper margin or aperture is slightly concave, and the lower margin is slightly curved, and makes an angle of about 25° with the axis, joining the common canal at a point a little lower than the aperture of the second lower hydrotheca, narrower at the junction with the common canal than at the aperture; hydrothecæ number from 8 to 9 in the centimetre. *Temnograptus magnificus* differs from all other species I have seen described in its enormous size: it is, however, closely related to *T. multiplex*, Nicholson, of the Skiddaw Series, which is characterised by the regularity of its dichotomous branching; but the former differs from the latter in the much greater variation in the length of the stipes between the bifurcations, in the angles at which the corresponding stipes diverge, and in the more crowded hydrothecæ.

The other species to which it is undoubtedly related, *Graptolithus flexilis*, Hall, *G. rigidus*, Hall, and *G. abnorm* Hall, of the Quebec Series, but it is easily separable f each of them.

These five species agree in that the hydrothecal-bear stipes are subdivided, and that there is no central corne disc present.

I have to acknowledge my indebtedness to Mr. T. S. H M.A., for suggestions on the subject matter of this pa and to Mr. W. S. Strettle for assistance in quarrying out specimen.

EXPLANATION OF FIGURES.

PLATE VI.

FIG. 1.—*Temnograptus magnificus*, one-seventh diameter of the original, drawn from a ph graphic reduction.

FIG. 2.—Portion of the stipe bearing hydrothecæ (enlarg

FIG. 3.—Central portion of polyp-stock, natural size.

Art. XI.—*Note on the Distribution of Victorian Batrachians, with Descriptions of Two New Species.*

By A. H. S. Lucas, M.A. Oxon., B. Sc. Lond.

[Read October 8, 1891.]

The Batrachians recorded from Victoria by Mr. G. A. Boulenger, in his British Museum catalogue of the Batrachia Salientia, published in 1882, are six in number, viz. :—

Limnodynastes tasmaniensis, Steindachner. Sandhurst.

Heleioporus pictus, Peters. Sandhurst.

Pseudophryne bibronii, Steind. Sandhurst.

Hyla ewingii, Dum. et Bibr. Melbourne.

H. parvidens, Peters. Port Phillip.

H. aurea, Lesson. Melbourne.

Sir Frederick McCoy, in his "Prodromus of Victorian Zoology," has fully illustrated three species, viz. :—

Limnodynastes tasmaniensis, Steind. Passim.

L. dorsalis, Gray. Sandy tracts about Brighton.

Hyla aurea, Lesson. Passim.

L. dorsalis was first recorded from Victoria by Sir Frederick McCoy.

In 1888, Mr. Boulenger described* a new species of frog sent to him by Mr. J. J. Fletcher, of Sydney. The single

* A.M.N.H., Vol. II (Sixth Series), p. 136.

specimen was from Warragul, and was named by Mr. Boulenger *Crinia victoriana.*

Lastly, about a year ago, Mr. J. J. Fletcher* mentions the occurrence of *Limnodynastes peronii,* Dum. et Bibr., also at Warragul.

In all then, up to the present, nine species of Batrachians are known from Victoria. Mr. Fletcher (*l.c.*), in alluding to this limited number, remarks, "The falling off in the number of species in the southern colonies is possibly, and very probably, in some degree rather apparent than real." This remark, as will be seen, has been fully justified. The researches of Krefft, and later on, those of Fletcher, have swelled the list of known New South Wales Batrachians to thirty-four. While we cannot expect to meet with so large a number in Victoria, it was improbable that there should be so great a difference in the size of the lists of species found in the two colonies.

I am now able to extend the number of Victorian Batrachians to sixteen. During our expedition last summer to the Upper Wellington, Dr. Dendy captured a beautiful specimen, which he handed over to me to determine. It proves to be a new species of Pseudophryne, and is described later on in this paper. This discovery led me to examine all the members of the order to which I could gain access. Professor Sir Frederick McCoy has shown me every consideration, and afforded me all facilities for examining the specimens which are preserved in the National Museum. Besides collections from various parts of Victoria of named and unnamed varieties, I had thus the advantage of handling a series of New South Wales forms received from Sydney. Professor Spencer and Dr. Dendy have placed all their specimens at my disposal. Several correspondents have kindly assisted me by forwarding living specimens from their respective districts. I have especially to thank the Rev. Henry Howard and W. B. Harvey, Esq., of Warragul; D. Clark, Esq., of Bairnsdale; and J. B. Lillie Mackay, Esq., of Sandhurst, for help of this kind. Mr. Charles Frost, in conjunction with whom I hope to prepare a monograph of this group for the Society, has obtained specimens from Gisborne, Macedon, Parwan, &c. I have, of course, also collected specimens myself wherever opportunity has presented.

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* P.L.S., N.S.W., Vol. V (Second Series), October 29, 1890.

Our Victorian Batrachians then include :—

CYSTIGNATHIDÆ.

Limnodynastes peronii, D. & B. Melbourne, Warragul, Bairnsdale.

L. tasmaniensis, Steind. Melbourne, Heidelberg, Carrum, Bairnsdale, Western District, Maryborough, Sandhurst.

L. dorsalis, Gray. Sandy tract from Prahran to Mordialloc.

Crinia signifera, Girard. Western District, Grampians, Melbourne, Heidelberg, Carrum, Waterloo in Gippsland.

C. victoriana, Boulenger. Warragul.

C. sp., Gunther. Oakleigh, Macedon, Christmas Hills, Narre Warren and Loch, Gippsland.

Heleioporus albopunctatus, Gray. Parwan, foot of Mount Macedon, Waterloo.

H. pictus, Peters. Sandhurst, Parwan (near Bacchus Marsh).

BUFONIDÆ.

Pseudophryne bibronii, Steind. Grampians, Sandhurst, Macedon, Gisborne.

P. dendyi, n. sp. Upper Wellington River, North Gippsland.

P. semi-marmorata, n. sp Oakleigh, Heidelberg, Ringwood, Narre Warren, Waterloo, Grampians.

HYLIDÆ.

Hyla peronii, Tschudi. Gunbower (near Murray River).

H. ewingii, D. and B. Brighton, Ringwood, Waterloo, Trafalgar, Warragul, Bairnsdale.

H. parvidens, Peters. Port Phillip (B.M. Cat.)

H. aurea, Lesson. All parts of the colony.

H. lesueurii, D. and B. M'Allister and Wellington Rivers.

I have examined specimens of all of these sixteen species, except of *Hyla parvidens* and of *Crinia victoriana*. It seems almost certain that this list will be further supplemented by the addition of species from the Murray, especially from the Gunbower lagoons, from the Western District and Mallee, and from East Croajingolong, while it is by no means improbable

that some other kinds will be found nearer to the metropolis. Mr. Frost and I hope to be able to give some account of these in our monograph.

Pseudophryne dendyi, sp. nov.

General shape and characters those of the genus.

Hind limb being carried forwards along the body, the tip of the longest toe reaches beyond the eye; the tibio-tarsal articulation does not reach the shoulder.

Skin slightly granular on the back, smooth below; small lateral folds.

Small inner and outer white metacarpal tubercles, subequal. Inner and outer white metatarsal tubercles; inner elliptical as long as first toe, outer rounded about half size of inner.

No glands present on the loins or thighs.

Dimensions.—From tip of snout to vent, 15 mm.; length of fore-limb from axilla to tip of third finger, 8 mm.; length of hind limb from vent to tip of fourth toe, 12 mm.

Colours of Life—Dorsal.—Head and trunk quite black, with many scattered small white dots, most numerous on the head and sides. The dots are aggregated, to form a superciliary white line over, and small white patches behind and below, each eye. A short median longitudinal yellow streak on the snout, from between the nares nearly to the mouth. On the rump, a yellow median longitudinal band, with a yellow blotch on each side behind (on back of thighs), forming an inverted T above the cloaca. Ventral.—Throat and belly quite black, marbled with irregular white blotches. Both black and white are dense opaque colours, clearly defined. With a lens, tiny black dots can be seen all over the white areas, and lighter dots all over the black ground. Fore limbs.—Black, with small white spots. The dorsal and post-axial surface of the arm (humerus) covered by a canary yellow patch of colour. Dorsal surface of hand white; fingers with white transverse bands, tips black. Hind limbs.—The surfaces of the limb seen from above, and the under side of the foot, are like the back, coloured black with small white dots. The surfaces of the limb, seen from below, and the back of the foot, are like the belly, black, largely marbled with white. Toes with white transverse bands and black tips.

A single male specimen, found by Dr. Dendy on our visit to Wellington River, North Gippsland. It was met with while we were turning over logs in search of Planarian worms, on one of the river flats, which gave evidence of being largely flooded in winter time.

PSEUDOPHRYNE SEMI-MARMORATA, sp. nov.

General form and characters those of genus.

Hind limb being carried forwards along the body, the tip of the longest toe reaches beyond the end of the snout. The tibio-tarsal articulation reaches to the shoulder.

Skin of top of head and back with several more or less distinct longitudinal linear series of rather conspicuous warts. Sides and belly smooth. Under surface of thighs near the symphysis granular.

Two small metacarpal tubercles, the outer rather larger. Two small metatarsal tubercles, subequal.

An oval orange-coloured gland on back of each thigh.

Dimensions of large specimen.—From tip of snout to vent, 31 mm.; length of fore-limb from axilla to tip of third finger, 13 mm.; length of hind-limb from vent to tip of fourth toe, 31 mm.

Colours of Life.—Top of head and back and upper surfaces of limbs olive-green, with darker spots; tips of warts often lighter. Vertebral line usually absent; when present, reduced to faint yellow streak on tip of snout, and another over hinder part of urostyle. Sides, blue black; throat, under sides of limbs, pale greenish yellow, more exactly a light shade of "brown pink," greener near axilla. Palmar surface of hand and plantar surface of inner 3½ toes, flesh-coloured. Belly light olive-green, marbled finely with white.

Met with in all the S.E. parts of the colony, south of the Divide.

Four species of Pseudophryne are recorded in Mr. Boulenger's Catalogue. All are confined to Australia. Mr. Boulenger suggests that two of the species, *P. bibronii* and *P. coriacea*, named by Steindachner and Keferstein respectively, may prove to be only varieties of the original *P. australis* of Gray. But Mr. Fletcher,* who has closely

* *Vide* Proceedings of the Linnean Society of New South Wales, Vol. IV (Second Series), p. 376.

studied both *P. australis* and *P. bibronii* in their native haunts, is quite convinced that they are good species, distinguished by constant differences in colour and pattern, in temperament, in habits, and in the time of the breeding season. *P. dendyi* is widely removed from all by its conspicuous black and white coloration. That *P. semimarmorata* is also very constant in its colouring and the pattern of the warts on the dorsal surface, I have found after examining dozens of specimens. In its geographical distribution, it is our southern representative of *P. bibronii*. the two forms only overlapping in the Grampians. We have thus another instance of the distinctness of species on the two sides of the Great Dividing Range.

ART. XII.—*The Magnetic Shoal near Bezout Island, off Cossack, N.W. Coast of Australia.*

By R. L. J. ELLERY, C.M.G., F.R.S., F.R.A.S.

Government Astronomer, Melbourne.

[Read Oct. 8, 1891.]

In *Nature* of March 19, 1891, p. 471, Commander E. W. Creak, R.N., states that in September 1885, on board H.M. surveying ship "Medea," when passing Bezout Island, near Cossack, N.W. Australia, a steady deflection of the compass of 30° was observed, whilst the ship was running over in a N.N.W. direction, and a depth of 8 fathoms of water.

When the "Penguin" surveying ship was in Hobson's Bay last Autumn, Lieutenant Coombe made magnetic determinations at our Observatory to test his instruments, and he described to me the experience of their vessel, the "Penguin," when at Bezout Island in November last year. The "Penguin" being two miles from the Island N. 79° E., a deflection of 22° was noticed in her compasses. On Bezout Island itself, the dip was normal, viz., 50° 2′ S., but 2·14 miles N., 79½ E. from the island, the needle dipped to 83° with very small deflection of the compass. This was, no doubt, nearly vertically over the disturbing force. The compass deflection increased, first on one side, and then on the other, as the magnetic centre was approached, within a hundred feet or so, or left behind a like distance.

So remarkable a phenomenon has attracted a good deal of attention, and I believe Captain Moore, the Commander, received instructions from the Admiralty to further investigate this abnormal magnetic disturbance. At all events, the "Penguin," on leaving this port, went back to Western

Australia and Bezout Island, and Captain Moore has made a thorough magnetic survey of the locality, and in a letter dated 22nd June this year, has sent me a copy of the official account of his work. As this subject will be interesting to the Society, and of importance to our nautical men going west about to Northern Australia, or the Straits, I now give Captain Moore's account verbatim :—

Magnetic Shoal near Cossack, W.A.

The area of magnetic disturbance near Cossack, exhibits the characteristics of red magnetism, as if there was a congestion or concentration of the magnetic elements, due to the Southern Hemisphere. It seems appropriate, therefore, to call it a "Magnetic Shoal"; and to treat it graphically, as if it was an elevation of the bottom of the sea or area of "shoal" water, the soundings being the "deflections" of the compass needle.

Worked out thus, it was found that the magnetic shoal developed the following features :—(1) An area 4 miles long north-east, and south-west by 2 miles broad; with a depth of 8 to 9 fathoms at low water springtide; bottom, quartz sand, over which the compasses are deflected one degree or more.

Within the above, an area 3 miles long north-east and south-west, by half a mile to 1½ miles broad, over which compasses are disturbed half a point or more.

Within the above :—(1) A line of maximum easterly repulsion, about 2¼ miles long, over which the north-seeking end of the needle is violently repelled to the east, in several places over 40°, and in one place 56°. (2) A line of maximum westerly repulsion, about 2¼ miles long, over which the north-seeking end of the needle is repelled to the west, to the extent of about one-half the easterly repulsion. (3) Between these two lines, which are from 200 yards to 600 yards apart, a line of no repulsion 2¼ miles long, over which the needle points to the true north, and the direction force is very small. This is called the "axis," or "line of vanished repulsion." (4) A point on this line, about one mile from the south-west end of the magnetic shoal, where the intensity is greatest, which is called the "focus." The axis, or line of vanished repulsion, is inclined to the true

meridian, at an angle of 56°, in the neighbourhood of the focus. This angle coincides with the angle of maximum easterly repulsion.

A vessel passing in a straight line across the magnetic shoal at the focus, on a north-westerly course, would find the north-seeking end of the needle behave in the following manner:—When about 1 mile from the focus, a slight disturbance would be observed, the north-seeking end of the needle being repelled to the east; but this disturbance would not amount to more than half a point, until she had run to within 500 yards of the focus; the needle would then be more and more repelled, until 300 feet from the focus, when it would be deflected as much as 56° from the true north. It would then quickly resume its correct position, and over the focus—for a hardly appreciable distance, say 8 feet—would point true to the north. After passing the focus, it would be repelled to the west, and at 200 feet from it, would be deflected as much as 26°. It would now begin to return again to its proper position, and at 600 yards from the focus on the north-west side, would not deviate from the normal more than half a point. At one mile from the focus, all signs of disturbance would disappear. Crossing the shoal rectangularly, elsewhere than at the focus, similar, but less powerful repulsion would be observed. The distance between the largest east and largest west repulsion would be greater.

In a wooden ship or composite vessel like the "Penguin," the compasses would act as usual after leaving the shoal. Whether or not induction would take place in an iron vessel, is a matter yet to be ascertained. At present there is no evidence of danger to navigation, except that a vessel steering by compass across the shoal would be set out of her course, more or less, according as to whether she cut across it at the narrowest part, or obliquely.

The focus is in latitude 20° 32′ 35″ S., longitude 117° 13′ 2″ E. from it. Bezout Island summit bears S. 78° 49′ W., distance 2·17 miles. The greatest range in deflection was 82°, after applying the deviation for the apparent position of the ship's head; the actual traverse of the card 86°. The greatest inclination or dip of the needle was 81° 10′. The greatest intensity or total force found was 18·808 (British units), or nearly double the intensity, which, in this locality,

is due to the earth considered as a magnet, *i.e.*, the magnetic attraction is such as to draw a weight of 1 grain, 18·808 feet in 1 second, in opposition to the force of gravity.

The statement made by Captain Creak, F.R.S., the Superintendent of Compasses, that the north-seeking end of the needle is repelled from the disturbing cause in the South Magnetic Hemisphere, is fully confirmed by this investigation.

ART. XIII.—*Notes on Victorian Rotifers.*

(With Plates XII and XIII.)

By H. H. ANDERSON, B.A., and J. SHEPHARD.

[Received December 11, 1891.]

During the last few months we have been working together on the Rotifera, and as one of us is leaving the colony, we have determined to record the results of our observations somewhat earlier than we otherwise should have done. Of one of the new forms, only a single specimen has been seen, and that by only one of us; but we have recorded this and other observations in the belief that they will be of use to other observers. Mr. Anderson has devoted his attention principally to the Rhizota, Mr. Shephard taking the other orders; but in nearly all cases we have been able to show each other, and to examine together, the various species that we have met with. In the case of new forms, seen by only one, we have indicated the fact by the use of brackets and the initials of the observer; we have not considered it necessary to do this in the case of known forms. We have appended to the names of the species the places where we found them, and what other information we thought might be of scientific interest, but have preferred to err on the side of brevity, rather than to insert unnecessary matter. Our authority throughout has been "Hudson and Gosse," which, with its supplement, is a complete record of all observations up to the date of its publication, three years ago.

ORDER I.—RHIZOTA.

FLOSCULARIADÆ.

Of the Floscularia we have met with :—

(i) *Floscularia coronetta.* In water from the Botanical Gardens, and from a pond near Oakleigh.

(ii) *F. ornata.* Botanical Gardens, Oakleigh, Brighton, &c.

(iii) *F. cornuta.* Botanical Gardens.

(iv) *F. campanulata.* Heidelberg, Brighton.

(v) *F. ambigua.* Oakleigh.

[and a species which I take to be new, and have named

(vi) *F. evansonii,* (n. sp.) It is a small species, much shorter and stouter in proportion to its size than most Floscules. It has five linear, knobbed lobes, in which it resembles *F. coronetta,* but it differs from it in having a broad cylindrical corona with a distinct rim, on which the lobes are inserted at some distance from each other. These lobes are short, less in length than the diameter of the corona, and are very motile, often coming right back till they lie in a plane at right angles with the axis of the body, and they remind one in their movements of the tentacles of the Polyzoa. The corona is broadly barrel-shaped, with a distinct projecting rim, and below it the body again expands somewhat before it tapers to the foot. The breadth of the body is nearly as great as that of the corona, and is one-third of the whole length, while in other species it is usually one-sixth or less. The tube is fluffy and irregular in shape. I found several specimens in water obtained on July 6th, 1891, from a backwater of a stream near Oakleigh. They were $\frac{1}{70}$th to $\frac{1}{80}$th in. in length, and were very bold, expanding freely. —H. H. A.]

[(vii) In water obtained from the Botanical Gardens on November 7th, I came across a single specimen of what is apparently a new species of *Stephanoceros.* It had a three-lobed corona, resembling *Floscularia trilobata,* but the setæ on these lobes were arranged as in Stephanoceros, *i.e.,* diagonally on the lobes in parallel bands. There were several of these bands round the summits of the lobes, and three or four in the centre of the depressions between them. The cilia of

these bands were in constant motion, creating a strong current of water, which brought particles from a considerable distance. This habit is, I believe, unique among the Flosculariadæ, though the one known form of Stephanoceros, *S. eichhornii*, is said to lash with its cilia at an escaping captive, and renders this form peculiarly interesting. I was unfortunately unable to make a careful study of the specimen, and have not since succeeded in finding another. It might be worth the while of other observers to search for this species in the place where I found it. The one specimen was $\frac{1}{20}$th in. in length.—H. H. A.]

MELICERTADÆ.

The Melicertadæ are well represented in Victorian waters, and not only have we met with many species, but these species were in almost all cases very numerously represented.

(viii) *Melicerta ringens* is common everywhere, and is sometimes very large. We have seen tubes more than $\frac{1}{15}$th in. in length.

(ix) *Melicerta conifera* is also fairly common, and sometimes most abundant. [I found it in thousands just after the floods in the back waters of Gardiner's Creek at Glenferrie, though a month after I could not find a single specimen there.—H. H. A.]

(x) *Limnias ceratophylli* is common; specimens $\frac{1}{10}$th in. to $\frac{1}{8}$th in. seen.

(xi) *Limnias annulatus* is somewhat rare; we have found it at Oakleigh, at Toorak, in a lagoon by the side of the Yarra, and in the Botanical Gardens.

(xii) *Cephalosiphon limnias.* Botanical Gardens.

(xiii) *Œcistes crystallinus.* Toorak, Brighton, Heidelberg.

(xiv) *Œcistes intermedius.* Oakleigh, Botanical Gardens, Heidelberg.

(xv) *Œcistes longicornis.* Botanical Gardens, Oakleigh, Heidelberg.

(xvi) *Lacinularia socialis.* Heidelberg.

(xvii) *Conochilus volvox.* Heidelberg, Melton.

(xviii) *Lacinularia pedunculata.* We found some colonies of this species at Brighton, and examined it carefully, subsequently mounting specimens. To the somewhat meagre description in Hudson and Gosse, we may add the following particulars:—The corona is circular, but for the indentation on the ventral side, which is shallower than in either *Megalotrocha alboflavicans* or *L. socialis.* The ventral antennæ are merely tubercles placed wide apart. The eyes are visible in the adult as very small red specks; they are seen with difficulty in living specimens, but are plainly visible in some of the mounted ones. One of the colonies was an old one, only a few adults were present, but it was full of eggs, and as we watched it, many of them hatched out. Some of them swam for some time with the foot still recurved on the body, but their motions were so active that we were unable to examine them closely. Attached to the weed close to the base of the large colony, was a small one, having a peduncle of the normal type, though very short, but the animals composing it were widely different from the full grown specimens. They had, however, a certain resemblance to the young ones just hatched from the eggs of the old colony. Unfortunately, we were unable to examine them carefully that evening, and they were all dead the next day. Since writing the above, Mr. Shephard has received from Mr. Whitelegge tracings of his drawings of *L. pedunculata,* and in these, one antenna is shown of the character that we have described above. Specimens have also been found by Messrs. Mann and Shephard at Heidelberg, but apparently the species is not common.

We have also met with some species which we take to be new.

(xix) *Œcistes wilsonii.* We found this form in water collected at Brighton Beach in July. It approaches *Œ. crystallinus,* but differs from it in the form of the body when fully expanded, and in the tube, which is gelatinous, clear and rounded, not fluffy and irregular. The corona is indistinctly two-lobed, nearly three times as broad as the body, dorsal gap minute, and the muscular thickenings of the corona more pointed than in the other *Œcistes* which we have seen. The antennæ are set flush on the body, so that

in the retractile state the setæ seem to spring from the body itself; but when the animal expands, that part of the body on which the setæ are situated becomes inflated, so as to form two projecting rounded cones on each side. These cones are placed some distance apart, and in ventral aspect their appearance is very characteristic, the body sloping outwards to their summits till it is half as broad again as it is at their base. When seen somewhat sideways, the anterior slope to the neck is very abrupt, and makes almost a right angle with the axis of the body. When recurved, the sides of the body are drawn back in a deep fold over the wrinkled foot, encircling it, till the bottom of the intestine touches the top of the foot. We observed three vibratile tags in each lobe of the corona, one on each side of the neck, and one in the body near the lower end of the stomach. Two red eyes were clearly seen in young nearly ready for hatching in the eggs. When first seen, the whole body was covered with a layer of gelatinous material, but in a specimen kept alive on a slide for a couple of days, this layer disappeared. Unlike most *Œcistes*, it attaches itself to its tube rather than to the plant on which the tube is fixed, resembling *Floscularia calva* in this respect. It sways itself from side to side, curving right over the edge of its tube.

Sp. ch. Corona indistinctly two-lobed, ventral antennæ placed on the surface of the body wide apart, the body when expanded projecting upwards and outwards to their point of insertion in two rounded cones. Tube gelatinous, rounded; length, $\frac{1}{75}$th in.

(xx) *Lacinularia reticulata.* This species has at first sight a considerable resemblance to *L. socialis*, but a more careful examination brings out points of difference important enough, we think, to prove it a new species. It is found in small colonies, often of only two or three specimens; the largest we have seen was composed of a dozen. In internal structure, it conforms to the usual type of Melicertadæ. Its distinctive features are a heart-shaped corona, as broad as long, and as broad half-way down as it is at its ventral end, giving it a somewhat rectangular appearance. This rectangular appearance is clearly shown in some specimens we mounted. The dorsal gap in the corona is comparatively large, and easily seen. But the most important point of difference between this and the other species of Lacinularia is the presence of antennæ, both dorsal and ventral. The dorsal antenna is

small, not to be seen when the creature is fully expanded, nor when fully retracted, but when partially expanded it may often be easily observed. It appears clearly in some of our mounted specimens. The ventral antennæ are peculiar in their position. They are papillæ, situated some distance below the neck on the body of the animalcule. When it is fully retracted, they are situated at its anterior extremity, and they too may be clearly seen in the mounted specimens. At their bases are two large pear-shaped masses of nerve matter (ganglia ?) connected with the nerve cord. As *L. socialis* has been most carefully examined by Huxley and others, it is impossible that the antennæ should have been overlooked had they been present in that form, and had they held the same relation to the nervous system that they do in the one we are describing. In the mounted specimens we noticed, too, that the corona appears beautifully reticulated on its under surface, and we subsequently observed it in living specimens. We found this species in large numbers at Brighton Beach.

Sp. ch. Corona broadly heart-shaped; dorsal gap comparatively large; dorsal antenna minute; ventral antennæ papillæ, situated half-way down the body, and wide apart, connected with pear-shaped nerve masses. Length $\frac{1}{25}$th in.

(xxi) *Limnias granulosus* (?). In water taken from the Botanical Gardens on November 8, we found a species which may be this. The tube was yellow, strewed with roundish brown granules, and transversely striated on the inside. But though there were numerous old tubes, there were only two with occupants. In these we observed that the two lobes were not nearly so greatly divided ventrally as in *L. ceratophylli*, and the ventral antennæ were somewhat more prominent. We were unable to see any horny processes, and the foot was certainly not forked, as that of *L. granulosus* is said to be. Hudson and Gosse, however, seem to doubt the forking of the foot, and the description seems generally doubtful. It will be worth while looking for this species somewhat earlier next year, and examining it carefully.

(xxii) *Œcistes intermedius.* We have seen two varieties of this Œcistes—one which we take to be the form mentioned by Hudson and Gosse, the other probably new. The one has the ordinary brown tube of *L. ceratophylli*, with moderately long antennæ; the other has a white tube, which

looks a greyish-black by transmitted light. This second form has very short antennæ, and the dorsal gap is somewhat wider, the edges of the corona at the gap curving somewhat outwards. The distinction seems hardly enough to mark a new species.

ORDER II.—BDELLOIDA.

FAMILY PHILODINADÆ.

(xxiii) *Philodina roseola.* Botanical Gardens.

(xxiv) *P. citrina.* Botanical Gardens.

(xxv) *Rotifer vulgaris.* Common.

(xxvi) *R. tardus.* Botanical Gardens.

ORDER III.—PLOIMA (Il-loricata).

FAMILY ASPLANCHNADÆ.

(xxvii) *Asplanchna brightwellii.* This was first noticed at Brighton, in July 1890. It was very plentiful, and numerous males were found. It appears to occur from June to September, as the pool at Brighton constantly visited, did not yield a single specimen for nine months of the year. Heidelberg yielded none, except in September 1891, when they were extremely numerous. Dr. Hudson remarks that his experience is, that the Asplanchnadæ do not occur in the same spot year after year—("The Rotifera," Vol. I, p. 26). But for two years *A. brightwellii* has been found in the same spot at Brighton.

(xxviii) *Asplanchnopus myrmeleo.* Found in all open pools tried, and at all times of the year, though numerous only on one occasion at Brighton.

FAMILY SYNCHÆTADÆ.

(xxix) *Synchœta pectinata.* Brighton and Heidelberg.

(xxx) *S. tremula.* Botanical Gardens.

lobed character, having a decided inward curve on either side, and a rounded termination overhanging the toes, the most marked departure being the setting of the claws which, instead of tapering off from the shoulder to the end, are recessed so as to form a reversed barb; the surface of the lorica was also stippled. Length about $\frac{1}{130}$th in.—J. S.]

(xlv) *Distyla ichthyoura* (n. sp.) Brighton. [The most distinctive character in this form, is the fish-tailed appendage to the posterior end of the lorica, which extends over half the length of two rod-shaped toes, each toe possessing a one-shouldered tapering claw. Anteriorly, the lorica has a dorsal crescentric excavation, forming two somewhat long lateral points. The lorica is finely stippled. The head is a truncated cone. There is a conspicuous eye. The trophi, as far as observed, resemble those of *C. luna*. Length $\frac{1}{125}$th in., breadth $\frac{1}{280}$th in. *Sp. ch.*—Lorica fish-tailed, stippled, crescentrically excavate in front, with somewhat long lateral points.—J. S.]

(xlvi) *Monostyla quadridentata.* Common.

FAMILY COLURIDÆ.

(xlvii) *Colurus bicuspidatus* (?). Brighton. [The specimens obtained closely resemble in most points the species doubtfully written, but differ in possessing two eyes very closely set, and two toes. Length $\frac{1}{220}$th in., depth $\frac{1}{450}$th in. Length of foot $\frac{1}{500}$th in.—J. S.]

(xlviii) *Metopidia solidus.* Brighton.

(xlix) *Metopidia ovalis* (n. sp.) Brighton. [The form figured is beautifully transparent, and shows the internal organs well. An egg-shaped lorica, broader posteriorly in its dorsal aspect, possesses a slight excavation at either end, the posterior one being at the summit of a slight projection formed by the lorica curving outwards laterally. The ventral plate has deep anterior and posterior openings of the form of a half ellipse. Two eyes are set wide apart, each at the base of a slight process set at each side of the corona. The toes and foot much resemble those of *M. solidus,* as do the general arrangement of the internal organs. Length $\frac{1}{200}$th in., breadth $\frac{1}{450}$th in.—J. S.]

FAMILY PTERODINADÆ.

(l) *Pterodina intermedia.* Brighton. Of this species only one specimen was seen, but the "semi-circular projection" at the anterior was distinctly visible. It is interesting to find here this species, which was first noted by my colleague as occurring among Indian rotifers (*Jour. Asiatic Soc.*, Bengal, Vol. LVII, Part II, No. 4, 1889). —J. S.]

(li) *Pterodina trilobata* (n. sp.) Sandringham. This specimen differs from any described species in the form of the dorsal plate of the lorica, it having the semicircular projection in front, with two broad bulgings on either side, giving it a tri-lobed appearance. The lorica is stippled, and so far as observed, inflexible. The coronal discs are widely separate, and there is a notch at the base of each disc, giving the median portion the form of a short broad lip. The gastric glands, so conspicuous in the genus, escaped observation, probably owing to the stippling of the lorica. Length of lorica $\frac{1}{250}$th in., extended $\frac{1}{140}$th in., breadth $\frac{1}{300}$th in.— J. S.]

FAMILY BRACHIONADÆ.

(lii) *Brachionus rubens.* Common.

(liii) *B. bakeri.* Common.

(liv) *Noteus quadricornis.* Brighton.

FAMILY ANUREADÆ.

(lv) *Anurea curvicornis.* Botanical Gardens.*

(lvi) *A. aculeata.* Common. Some three or four other species of Anureadæ have been partially worked, but not sufficiently to include them as determined species.

* The habitat Botanical Gardens refers in all instances to the Botanical Gardens, Melbourne.

DESCRIPTION OF PLATES.

PLATES XII AND XIII.

FIG. 1.—*Floscularia evansonii*, n. sp. × 200.

FIG. 2.—*Lacinularia reticulata*, n. sp. × 120. Left-hand figure partially contracted to show both antennæ.

FIG. 2A.—The same, viewed dorsally, × 200.

FIG. 3.—*Œcistes wilsonii*, n. sp. × 200.

FIG. 3A.—The same, showing fold back of the body over the foot in the contracted state, × 75.

FIG. 3B.—The same, showing appearance of corona and antenna viewed from the side, × 75.

FIG. 4.—*Cathypna*, n. sp. × 290. Viewed dorsally.

FIG. 5.—*Distyla ichthyoura*, n. sp. × 375. Dorsal aspect. Owing to failure of material, the internal structure was not fully made out, but distinctive specific characters are shown.

FIG. 6.—*Metopidia ovalis*, n. sp. × 525. Ventral aspect.

FIG. 6A.—Anterior of same, viewed dorsally, × 500.

FIG. 7.—*Pterodina trilobata*, n. sp. × 315. Dorsal view.

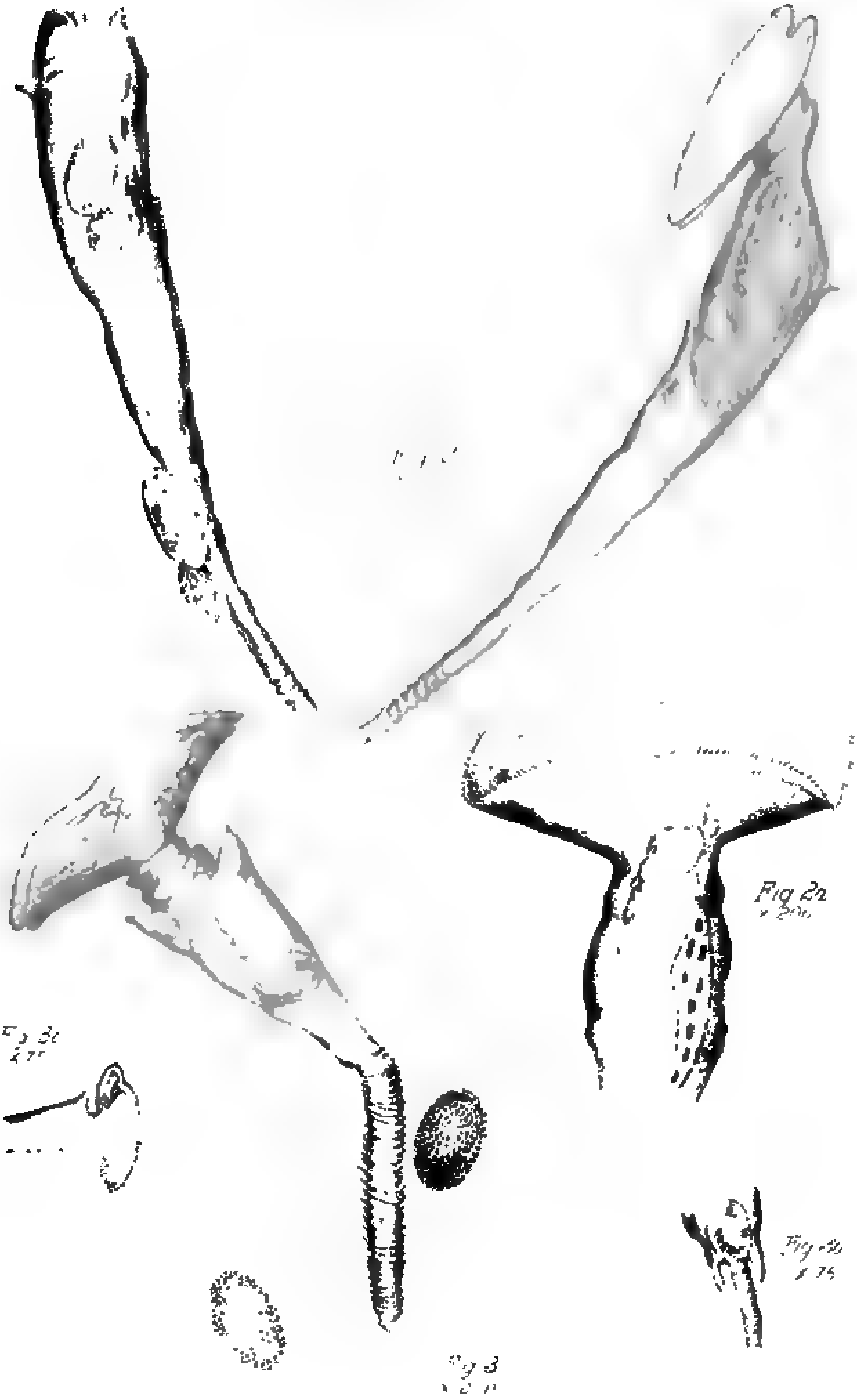
Fig 2a
Fig 3

ART. XIV.—*Note on the Habits of Ceratodus forsteri.*

By W. BALDWIN SPENCER, M.A.

Professor of Biology in the University of Melbourne.

[Read December 10, 1891.]

With the exception of a short account given by Mr. Caldwell before the Royal Society of New South Wales with regard to the spawning and reproduction of Ceratodus I am not aware of there being any note recently published with regard to the habits of this animal. Having lately had the opportunity of visiting the Burnett and Mary River districts, I was enabled to gain a little information with reference to its habits which may prove of interest.

As is well known, the group Dipnoi contains only three forms, of which one (Lepidosiren) is found only in Brazil, another (Protopterus) is confined to West Africa and the third (Ceratodus) at the present time exists only in the Burnett and Mary Rivers in Queensland. My remarks have reference to the Burnett District for though I was for a short time near the Mary River at Gympie I did not there come in contact with the animal.

In the first place, care must be taken with regard to the name; neither of the terms lung-fish or mud-fish, so far as my experience goes, is known to the settlers in the district. Neither at Gympie on the Mary, nor at Gayndah and other places along the Burnett, did those with whom I conversed on the subject recognise Ceratodus under either of these names. It has however two common names, one of which is the "Burnett Salmon," and the other the "Barramunda." Care has, however, to be taken when the latter name is used, since this is properly applied to a very different form, a true teleostean fish (*Osteoglossum leichardti*), which is not found

in the Mary or Burnett Rivers, but further north, in the Dawson and Fitzroy. The name of Burnett Salmon is given for the simple reason that the flesh is of a pink colour; beyond this, there is not the slightest resemblance between the two forms. In his recent report of the Queensland fishes, Mr. Saville Kent states that the Ceratodus is much prized as food. This is a mistake, for, as a matter of fact, it is very oily and disagreeable and only eaten by Chinese and those who can afford to get nothing better. From a scientific point of view this is a great advantage and will in no small degree tend to ensure its preservation.

The Burnett River runs in a wide channel, with banks often as much as fifty feet high, through country which is very sandy and undulating with hill ranges, the surface being composed in large part, at all events, of decomposed granitic rocks. For the greater part of the year, during all the warm months, the river channel shows wide sand banks, with only a comparatively narrow and shallow stream of water, broadening out every now and then into wide deep pools, where the river bed and banks are often formed of great granite rocks. Into the river run numerous creeks, the beds of which are usually quite dry and sandy in summer. The Ceratodus always stays in the deep pools, and fishers know well that it is to these they must go if they want to catch the animal. It is possible that on rare occasions it might bury itself in the mud, or to speak more correctly sand, but it by no means normally does this, and speaking generally, I think it is safe to say that Ceratodus always stays in the deep pools which through the heat of summer retain at any rate a fair suply of water. In a season of drought these pools may become isolated, but it is a rare season in which there is not a plentiful trickle from one pool to another, and some of these pools are quite a mile long.

Whilst Protopterus makes cocoons of mud for itself during the season of drought and is enabled to live through the latter by the aid of its lung, its ally, Ceratodus, does no such thing. Quite on the contrary, I believe that its lung is, at all events as useful to it, if not more so, during the rainy as during the hot season; at the same time, it is always of use as a subsidiary organ of respiration.

It may here be mentioned that out of the water Ceratodus is the most helpless and passive creature imaginable. It is perfectly incapable of movement, its weak limbs, which

serve well enough as paddles in the water, being quite incapable of sustaining the weight of the body or of assisting in movement. You may put a Ceratodus within a few feet of the water, and there it will lie perfectly passive and making not the least attempt to move. When left in air without being surrounded by damp moss or weeds, its life is limited to a very few hours, eight or ten at most—a length of time exceeded by both the eels and dew fish taken from the same water. If kept damp, however, it will live for a considerable time, and may be carried alive for long distances in this way.

It is most interesting, however, to watch the animal on land. The gill flaps remain closed, and the animal opens and closes its mouth at regular intervals in such a manner as at once conveys the idea of breathing. Not only this, but when in the water it comes at intervals to the surface and expires and inspires air. In the evening, when seated by the edge of a pool, one can hear what the fishermen of the district call a "spouting," and which is due, as in the case of the whale, only on a much smaller scale, to the expiration of air just as the animal reaches the surface. I was not able to actually see the Ceratodus doing this, but was assured by several who were well acquainted with its habits that the noise was made by the Ceratodus.

When the season is very dry and a comparatively small pool is chosen, it is possible, by continuously stirring up the mud and sand, to choke the fish but at the same time, though the latter are killed, the Ceratodus will continue alive.

Now, if we take into consideration the nature of the country through which the Burnett River runs and the fact that the Ceratodus does not require to, and practically never does, leave the water pools, we may gain some idea of what is at all events one chief use, if not the main one, of the lung structure.

In the rainy season the creeks, dry in summer, become converted into roaring torrents; the river rises suddenly, as much sometimes as fifty feet in a very few days, and down from the hills and the country round an enormous amount of sand is swept suddenly into the water. When once the big sand banks of the River have been seen in dry weather it is easy to realize what a vast amount of sand must be swept down into the stream at flood time every year and of

what great advantage must be the possession of an organ which will enable Ceratodus under such circumstances to breathe air directly whilst at the same time it remains in its ordinary element.

It is thus probably during the flood season when the waters are muddy that the lung is of great service to the animal. At the same time, in seasons of drought, if the animal be left in a comparatively small pool, the waters of which get almost stagnant and foul from the decomposition of the fast growing weeds, the possession of the lung would again be of the greatest value. On the whole, however, if we consider the nature of the country, the sudden floods to which yearly the river is liable, with the consequent pollution of the water, together with the fact that the animal lives in deep and extensive pools, we shall probably be right in concluding that the lung is of especial advantage during the wet, rather than during the dry season.

It may be noted in conclusion that Ceratodus seems to live principally, if not entirely, on vegetable matter. The alimentary canals of those which I opened in late September and early October, being filled with the fruit of the gum tree *Eucalyptus tereticornis* which overhangs the river banks. The fruit seems to pass entire into the alimentary canal without being crushed by the teeth in the mouth.

PROCEEDINGS.

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CONTENTS OF VOLUME IV, PART II.

ART. XV.—*On an Australian Land Nemertine (Geonemertes australiensis, n. sp.)*

(With Plates VII, VIII, IX, X.)

By ARTHUR DENDY, D. SC., F.L.S.

[Read July 9, 1891.]

CONTENTS.

1. INTRODUCTORY REMARKS.

In the *Victorian Naturalist* for December, 1889, I recorded the discovery of three specimens of a terrestrial Nemertine at Walhalla, Gippsland, Victoria, and gave a brief description of the general appearance of the animal.* Being unable, at the time, to obtain access to Professor von Graff's paper on *Geonemertes chalicophora,*† which it was

* "Zoological Notes on a Trip to Walhalla," *loc. cit.* p. 132.

† "*Geonemertes chalicophora*, eine neue Landnemertine," Morphologisches Jahrbuch, Bd. V, 1879, p. 430.

supposed (though without any conclusive evidence) might be an Australian form, I refrained from naming the species. Recently, however, thanks to the kindness of Professor von Graff, Professor Haswell, Professor Spencer and Professor Howes, I have received several copies of the paper in question, and as there can no longer be any doubt that the species is perfectly distinct from any that have been previously described, and as I have since obtained an abundant supply of material from various localities, I have decided to give a detailed description of the new species in this place, under the name *Geonemertes australiensis*.

In addition to the gentlemen whose names are mentioned above, I desire also to record my indebtedness to the following for valuable assistance and material, viz.:—Mr. J. J. Fletcher, M.A., for the loan of two specimens of *Geonemertes* (sp. ?) from Tasmania and New South Wales respectively;* Mr. J. Bracebridge Wilson, M.A., Mr. E. F. J. Love, M.A., Rev. W. Fielder, Mr. C. C. Brittlebank, Mr. Shephard and Mr. Fiddian for specimens from various parts of Victoria; and Mr. T. Whitelegge, of the Australian Museum, Sydney, for most kindly photographing for me the plate illustrative of von Kennel's paper on *Geonemertes palaensis*,† which I have been unable to obtain.

2. Habitat and Distribution.

Geonemertes australiensis is a thoroughly cryptozoic‡ animal. The first specimen which I found was beneath a stone, but since then most of the numerous specimens discovered have been found under rotting logs. As might be expected the animal seems to like a tolerably damp situation, apparently it does not burrow in the earth but simply lies beneath its shelter. Since I first recorded it from Walhalla it has been obtained from the Otway Forest (Mr. Wilson and Mr. Love), Creswick (Mr. Fiddian), the Upper Yarra district (Professor Spencer),§ Narre Warren (Professor Spencer), Myrniong (Mr. Brittlebank) and the Fern Tree Gully district. The most remarkable discovery was that at Fern Tree Gully, on the occasion of an expedition made by the Field Naturalists' Club of Victoria, on March 14, 1891,

* *Vide* Proc. Linn. Soc. N.S.W., April 29, 1891.

† Arbeit. Zool.-Zoot. Inst., Wurzburg, IV., 1877-78.

‡ For explanation of this term *vide Victorian Naturalist, loc. cit.*

§ *Vide Victorian Naturalist*, March-April 1891, p. 179.

when we found dozens of specimens under fallen logs. It is a curious fact that on most carefully searching the same locality only a few weeks later (May 13) I was unable to find a single specimen.

Mr. Fletcher* has lately recorded the occurrence of land Nemertines also in Tasmania and New South Wales, but it is somewhat doubtful whether they belong to the same species as the Victorian specimens, though from the examination of the external characters which I have been kindly permitted to make I am inclined to believe that they do.

3. External Characters, Habits, and Methods of Preparation.

As it lies at rest, with the proboscis retracted, *Geonemertes australiensis* has very much the appearance of a slug or a small Planarian worm, and is very soft and slimy. When it begins to crawl, which it readily does on being disturbed, the body elongates until in large specimens it measures about 40 mm. in length by 2·5 mm. in greatest breadth. The anterior extremity is then seen to be rounded and perhaps slightly swollen into a head, the posterior extremity tapering gradually to a blunt point where the anus is situated. The ventral surface of the body, on which the animal crawls, is somewhat flattened.

The colour of the living animal is chiefly yellow, varying a good deal in shade, and lighter on the ventral than on the dorsal surface. Sometimes it is a translucent, waxy yellow, sometimes orange, and sometimes more brownish. Figure 1 represents a specimen from near the Wood's Point Road, painted from life. In this case the dorsal surface was brownish yellow edged on either side by a narrow band of creamy white continuous with the creamy white ventral surface. Usually there are no stripes but sometimes there is a brown median dorsal band, and in a specimen from Myrniong, which I take to belong to the same species, there were two narrow stripes of a darker brownish tint down each side of the mid dorsal line, the remainder of the dorsal surface being of the usual yellow colour. Sometimes, in large specimens, the sides of the body have a distinctly mottled appearance, due to the large ova showing through the skin. At the extreme anterior end of the body, on the

* *Loc. cit.*

head, is a single aperture, the common opening of the proboscis sheath and alimentary canal, or, to speak more exactly, the opening of the rhynchodæum. A little behind this aperture there is, on each side of the head and somewhat more towards the dorsal than towards the ventral surface, an irregular group of minute black specks, the eyes. The number of the eyes is probably not constant, and the size is certainly very variable; in one specimen examined there were about twenty in each group.

On the ventral surface of the head are situated the two very minute openings of the cephalic pits, one on either side of the middle line, but these are only recognisable in sections, though sometimes there appears to be a transverse groove, visible with a pocket lens, in which they probably lie (Fig. 3.)

The animal crawls normally with an even, gliding motion, much like a Planarian, leaving behind it a slimy track. The motion is probably due in part to muscular and in part to ciliary action, the proboscis being at the time completely withdrawn into the body. If the worm is irritated, however, the proboscis is suddenly shot out from the anterior end with wonderful rapidity. This proboscis is relatively of enormous size, being, even when shot out only to the normal extent, fully as long as the body of the worm, if not longer. After remaining out for an instant it is more slowly withdrawn and this eversion and withdrawal may be repeated several times in rapid succession. Frequently, however (Fig. 12), the proboscis breaks away from its attachment round the mouth of the proboscis sheath and remains attached to the body of the worm only by the retractor muscle, which appears as a long, narrow thread coming out from the opening of the rhynchodæum. When detached in this manner the proboscis is actually larger than the body of the animal. The colour of the everted proboscis is pure white and its surface is quite furry from the presence of innumerable little glandular papillæ, which secrete a sticky fluid. Under normal conditions the proboscis may probably be everted and withdrawn again for an indefinite number of times. When fully extended it adheres slightly to the surface on which it falls and hence, as a necessary consequence, when the proboscis is withdrawn again the body of the animal is pulled forwards over it. In this way the animal may progress, using the proboscis as a means of locomotion. In the case of *Tetrastemma agricola* von

Willemoes-Suhm appears to regard* this as a normal mode of locomotion. From my own observations I am inclined to regard it as accidental, and I think that the proboscis is normally used only as a weapon of offence or defence, probably for catching insects, but this I have not observed. As already stated, when the animal is crawling under ordinary circumstances the proboscis is entirely withdrawn into the body.

So much for the external characters of the living animal. Before passing on to describe the minute anatomy it may be as well to say a few words as to the methods of killing and preserving specimens. Unfortunately the animal is so large and opaque that it is difficult to study the internal anatomy satisfactorily in the living worm, and, owing to the extreme irritability of the proboscis and the delicacy of the whole organism, it is an unusually difficult matter to kill and preserve the animal in a satisfactory condition, for the violent movements of the proboscis are very apt to cause the body to break up.

The following are the results of a number of experiments which I made with a view to finding the best method of killing and preserving specimens :—

(*a.*) By suddenly immersing the living worm in strong methylated spirits. This is sometimes successful, but the proboscis is always more or less everted in the spirit and frequently the body breaks up.

(*b.*) By suddenly immersing in very dilute aqueous osmic acid. Only one specimen was tried ; the proboscis was everted and the body broke up badly.

(*c.*) By suddenly immersing in a cold saturated alcoholic solution of corrosive sublimate. This is fairly successful but the proboscis is always everted and sometimes the body breaks.

(*d.*) By pouring a hot aqueous solution of corrosive sublimate on the living worm. This kills the animal nearly instantaneously, with the body generally intact but the proboscis everted. The heat employed, however, can scarcely fail to injure the histology of so delicate an organism.

(*e.*) By first holding the worm in the vapour of chloroform for about half a minute. Hold the worm on a lifter or glass

* "On a Land-Nemertean found in the Bermudas," *Annals and Magazine of Natural History*, Series 4, Vol. XIII, 1874, p. 409.

slip over an open jar containing a little chloroform, the animal contracts to its normal resting condition and is rapidly stupefied. Then quickly plunge the stupefied worm into strong spirit, taking care not to let the surface of the body adhere to the lifter. The animal is thus killed and hardened while under the influence of chloroform and the proboscis is not everted at all nor does the body break up, but the worm retains when dead the normal resting position. In making use of this method it is important to leave the worm in the chloroform vapour for neither too short nor too long a time; if the former, it regains its activity in the spirit and everts the proboscis; if the latter, it dies and adheres to the lifter or glass slip on which it lies.

This last I find to be by far the most satisfactory way of killing and preserving specimens, and it is the only method known to me by which the proboscis can be retained within the body in its natural position. Of course other hardening fluids besides alcohol may be used after stupefying with chloroform vapour.

Frequently, however, it is very desirable to preserve specimens with the proboscis everted, and for this purpose I recommend methods *a.* and *c.*

My researches on the minute anatomy of *Geonemertes* were conducted chiefly by means of sections taken in three planes (horizontal, sagittal and transverse), stained with borax carmine or Kleinenberg's hæmatoxylin, and cut by the ordinary paraffin method. Both methods of staining should be employed, as the results obtained are very different in the two cases; hæmatoxylin, for example, brings out with wonderful distinctness the network of excretory tubules, which I failed to recognise in the specimens stained with borax carmine.

4. Minute Anatomy.

a. Epidermis and Sub-Epidermic Tissues.

The epidermis and subjacent tissues may be studied very satisfactorily in sections stained with borax carmine; hæmatoxylin I have found very unsatisfactory for this purpose.

The appearance of the epidermis in sections varies a good deal with the state of contraction of the particular part of the body which it covers. Frequently it is thrown into slight folds and sometimes it is so stretched that it becomes

very much thinner than in its normal condition, while the component cells are much more difficult to make out.

In favourable preparations, however, the epidermis is seen, very clearly indeed, to consist of very slender, greatly elongated, columnar cells, placed closely side by side. (Fig. 9, *ep.*) Each cell is broadest at its outer end and tapers gradually to a fine point imbedded in the subjacent tissue. About the centre of each is an elongated, deep-staining nucleus. The outer surface of the epidermis is richly ciliated.

Beneath the epidermis is a well-developed layer of unicellular glands (Fig. 9, *gl. c.*) The gland-cells are pear-shaped, with the narrow ends pointing outwards. Each contains a small nucleus and a larger or smaller quantity of finely granular material. These gland-cells are much more numerous and contain much more of the granular contents, on the dorsal than on the ventral aspect of the body. There can, I think, be no doubt that they secrete part of the slime with which the surface of the body is covered.

Scattered between the gland-cells and amongst the tails of the epidermic cells are numerous small, darkly staining nuclei (Fig. 9, *nu.*), whose exact relations I have not been able to make out. Around and beneath the gland-cells we also see a quantity of very finely granular material which scarcely stains at all with borax carmine and which extends inwards to the circular muscle layer. This tissue (Fig. 9, *b. m.*), in which a few scattered nuclei are imbedded, evidently constitutes the basement membrane already frequently described by writers on Nemertean anatomy.

b. Muscular System.

Within the basement membrane there are two well-developed muscular sheaths completely investing the body, viz., an outer sheath of circularly disposed muscle fibres and an inner sheath of longitudinal ones. Between these two principal sheaths there is a very thin and delicate layer of diagonally disposed muscle fibres.

The outer, circular, muscle sheath (Figs. 6, 7, 8, 9, 10, *c. m.*) is well developed and of about equal thickness all round the body, it is not, however, nearly so thick as the longitudinal sheath.

The inner, longitudinal muscle sheath (Figs. 6, 7, 8, 9, 10, *l. m.*) is more strongly developed on the ventral than on the

dorsal surface of the body, doubtless in relation to the crawling movements of the animal. In transverse sections it is very clearly seen to be broken up into blocks by small bundles of muscle fibres which run inwards from the circular sheath to the deeper parts of the body (Figs. 8, 24).

The layer of diagonal or oblique muscle fibres (Fig. 10, *o. m.*) is very thin and consists of two series of fibres crossing one another obliquely, just as in *Geoplana*,* only in a different position. This diagonal layer in *Geonemertes australiensis* is very clearly recognisable in tangential sections along the sides of the body, much as is represented in Figure 10, taken from a specimen stained with borax carmine. I should not like to say positively that it extends completely round the body, but it probably does, though I have not been able to detect it with certainty in the mid-dorsal and mid-ventral regions.

In the head-region there is a special and very important development of muscles in relation to the proboscis sheath (*vide* Figs. 2, 3, 4, 5, 6). At about the level of the centre of the cerebral ganglia the longitudinal muscle sheath splits into two layers, an inner and an outer. The outer layer (*l.' m.'*) passes forwards in the old position. The inner layer (*m. d.*), on the other hand, passes forwards and inwards to join the proboscis sheath at the place where the proboscis is attached to it, immediately in front of the cerebral ganglia and behind the mouth. There is thus formed a distinct muscular diaphragm (Figs. 2–6, *m. d.*), convex anteriorly. lying immediately in front of the cerebral ganglia and behind the mouth. The musculature of the proboscis and its sheath, with which this muscular diaphragm is continuous, will be described in dealing with those organs.

I have already mentioned that numerous small bundles of muscle fibres run inwards from the region of the circular muscle sheath through the longitudinal sheath to the deeper parts of the body. Many of these small bands unite together to form a series of strong dorso ventral muscular bands which run in a vertical direction between the lateral diverticula of the alimentary canal.

c. *Alimentary Canal.*

The alimentary canal agrees very closely indeed with that of *Geonemertes chalicophora*, as described and figured by

* *Vide* Dendy "Anatomy of an Australian Land Planarian," Trans. Royal Soc. Victoria, 1889.

Professor von Graff.* The mouth, as already observed, is situate just in front of the cerebral ganglia, within the rhynchodæum (Fig. 6, *m.*) The alimentary canal, as observed by von Graff, is divisible into two sections, the œsophagus and the gut proper, which differ essentially in the character of their lining epithelium. The œsophagus (Fig. 6, *œs.*) is at first a very narrow and short tube, with thin walls (*œs.* 1), which passes obliquely backwards and downwards beneath the ventral commissure of the cerebral ganglia. Behind the ganglia it suddenly dilates into a large saccular structure with thick and folded walls (*œs.* 2), lying beneath the most anterior portion of the proboscis sheath; then it contracts again to form a straight, short, thin-walled tube (*œs.* 3) springing from the posterior dorsal region of the saccular portion. At its posterior extremity the straight, thin-walled tube joins the gut proper. The relations of the different regions of the œsophagus to one another and to the other organs of the body will be best understood by reference to Figure 6, representing a median longitudinal section through the anterior extremity of the body.

The wall of the œsophagus is made up of more or less elongated, darkly staining, nucleated and richly ciliated columnar cells, and the transition from this epithelium to that of the gut proper is a very sudden one (Fig. 6). Von Graff considers the thick walls of the saccular portion of the œsophagus to be of a glandular nâture; this may also be the case in our species, but the columnar cells composing them are certainly very richly ciliated.

The gut proper, or intestine, runs straight from the œsophagus to the anus, which is situated at the posterior extremity of the body (Fig. 12, *a.*) The median portion of the gut lies exactly beneath the proboscis sheath, but it gives rise on either side to a large number of irregular, often branched, saccular or lobate diverticula, which pass outwards and upwards on either side of the proboscis sheath, closely embracing it (Fig. 8).

Just where it joins the œsophagus the gut gives off, as usual, a characteristic diverticulum (Fig. 6, *d. gut*), which runs forward beneath the last portion of the œsophagus and ends blindly.

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* *Lcc. cit.*

The digestive epithelium has been admirably described by Professor von Graff in the case of *Geonemertes chalicophora*, and aptly compared to that of the Planarians. His remarks apply equally well to our species. Only in a condition of rest or hunger are the digestive cells clearly recognisable, when they have the form of elongated, columnar cells, apparently not ciliated. When digestion takes place these cells elongate, put out amœboid processes, seize hold of the food particles and run together into a protoplasmic network which may finally completely obliterate the lumen of the alimentary canal, which then appears to be filled with a granular vacuolated mass of protoplasm (syncytium). The digested food material is then, apparently, passed out to the surrounding tissues, after which the digestive cells regain their normal condition, or, as seems to me possible, are replaced by new ones.*

Digestion seems to go on chiefly in the lateral diverticula, which generally appear in sections to be more or less filled with a granular syncytium as shown in Fig. 8. In crushed preparations of the living animal this granular material is very obvious in the lateral diverticula and can be easily squeezed out into the central portion of the gut and thence through the anus.

d. The Proboscis Sheath and Proboscis.

The proboscis and its sheath have essentially the same structure as in other Hoplonemertines and a brief description of these parts will therefore suffice. The sheath (Figs. 6, 7, 8, *p. s.*) is a hollow tube running along in the dorsal region of the body above the alimentary canal, and extending from its opening at the anterior extremity to its blind end very near the posterior extremity. It has well-developed muscular walls lined internally by a layer of epithelium. The thickness of the muscular part of the wall, as also that of the epithelial layer, varies much according to the state of distention of the sheath. When the proboscis is completely retracted the walls of the sheath are necessarily much distended and appear relatively thin, while when the proboscis is everted the lumen of the sheath becomes much narrower and its walls much thicker. The muscular portion

* Compare my account of the digestive epithelium in *Geoplana spenceri* (*loc. cit.*) which was written before I had seen von Graff's remarks on the subject.

of the wall of the proboscis sheath consists of longitudinally and circularly disposed fibres irregularly mixed together, and not arranged in definite layers as seems to be the case in other Hoplonemertines.* Just in front of the anterior attachment of the proboscis, and just behind the mouth, the wall of the rhynchodæum† forms a kind of muscular sphincter, which, when the proboscis is completely withdrawn, closes the entrance. This is not seen in any of the sections figured, but it is very distinctly visible in horizontal sections of a specimen killed with the proboscis retracted.

The cavity of the proboscis sheath, or rhynchocœlom, is filled with a liquid in which float numerous elongatedly spindle-shaped corpuscles, each about 0·09 mm. in length and about 0·0036 mm. in greatest transverse diameter. The two ends of the spindle are very gradually and sharply pointed; the substance of which it is composed stains fairly well with hæmatoxylin, and is scarcely at all granular except in the middle of the cell, where there seems to me to be a nucleus. Von Graff describes similar but smaller bodies in *Geonemertes chalicophora*, but states that they have no nucleus. I can offer no suggestion as to the possible use of these remarkable bodies.

On slitting open the proboscis sheath in an animal which has been killed with the proboscis retracted the latter organ is seen packed away in the sheath in a much bent and crumpled condition. The folding of the proboscis within the sheath appears to be very irregular, and is necessitated by its great length, which far exceeds that of the sheath which has to contain it. If we now gently pull the proboscis away from the sheath (Fig. 13) we shall find that it is attached to the latter at two points, (1) at the anterior extremity, where the muscular walls of the sheath and proboscis become continuous all round (Fig. 6, *m. p.*, Fig. 13, *a. a.*, Figs. 12 and 14, *a.' a'*), and (2) at the posterior extremity of the proboscis, which narrows out to form a long retractor muscle (Figs. 13, 14, *r. m.*) whose end is attached to the inner surface of the wall of the sheath a little in front of the blind end of the latter (Fig. 13, *p. a.*)

The proboscis consists of three main divisions—(1) most anteriorly, the eversible portion (Figs. 14, 15, *e. r.*) which is

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* *Vide* von Graff, *loc. cit.*

† The rhynchodæum is the cavity into which the proboscis sheath and alimentary canal both open.

a glandular nature. Possibly, as Bürger suggests,* they secrete the material which forms the handle of the stylet. This layer of glandular, deeply staining cells is interrupted by the sacs which contain the "reserve" or "accessory" stylets. These sacs (Fig. 16, *s. r. s.*) have the appearance of irregular, clear, rounded spaces; they are not definitely two in number, as appears to be the case in *G. chalicophora,* but their number varies: I have counted as many as five in a single specimen. Nor do they appear to be constant in position, although in the section represented in Fig. 16 two sacs happen to be cut through in a position which seems to have a definite relation to that of the poison canal. Each sac contains about four accessory stylets, whose structure will be considered later on.

Outside the layer of glandular cells is a very thin, uninterrupted layer of longitudinal muscle fibres, followed immediately by a delicate external epithelium, which is extremely difficult to recognise. I could find no trace of an external circular layer of muscles in the stylet-region of the proboscis.

Certain structures in the anterior half of the stylet-region require further notice. These are the stylets, the stylet-handle and the poison canal. All these parts may best be studied in a longitudinal section of the proboscis taken in the plane of the central stylet and poison canal. Such a section is represented in Fig. 15. It will be seen that the stylet-handle is a somewhat pear-shaped structure whose broader end is posterior, while into the narrower end is inserted the base of a stylet, whose apex projects forwards into the lumen of the eversible portion of the proboscis. At one side of the stylet-handle a narrow "poison canal" (*p. d.*) leads up from the "poison reservoir" (*p. r.*) in the posterior half of the stylet-region. This poison canal leads up to the base of the central stylet The stylets themselves are sharp-pointed, perfectly transparent needles, about 0·12 mm. long and of the shape shown in Fig. 17. Each resembles a nail, with a slightly enlarged head separated from the remainder by a slight constriction. The inner portion appears to be softer than the outer, from which it is pretty sharply marked off, and near the base, or head, is (at any rate in the reserve stylets) a small space, quadrangular in lateral view, which is

* "Untersuchungen über die Anatomie und Histologie der Nemertinen, &c," Zeitsch. für wiss. Zoologie, Vol. 50, p. 1, 1890.

divided by a slight transverse constriction into two portions (Fig. 15), an anterior, which seems, as pointed out by von Graff, to belong more properly to the eversible portion of the proboscis, and a posterior, which seems to belong to the non-eversible portion. For the sake of convenience, however, I follow von Graff in considering these two portions together as a separate region of the proboscis, the stylet-region. In longitudinal sections, however (Fig. 15), the two portions of the stylet-region are seen to be even more sharply marked off from one another than appears from the outside.

The structure of the anterior half of the stylet-region is very complicated. If we take a transverse section across it (Fig. 16) we shall see that it is nearly solid. In the centre is a deeply staining, homogeneous mass (Fig. 16, *h.*), circular in outline; this is the so-called "handle" of the stylet, which appears to be of the nature of a secretion. This handle is surrounded by a rather thin layer of radiating muscle (?) fibres, attached to the "handle" at their inner extremities. Outside this layer of radiating fibres comes a rather thin layer of circular fibres, interrupted at one side of the handle by the "poison-duct" (*p. d.*), which contains a granular material. The boundary between the layer of radial muscles and the circular layer is very sharp and distinct and gives one rather the impression of being the wall of a cavity across which the radial fibres run to their insertion in the handle of the stylet. The layer of circular fibres is not very regular, and is seen in longitudinal section (Fig. 15) to be more or less interrupted by radial bands, it is thicker behind the handle of the stylet than around it. Outside this circular layer is a very thick layer of longitudinal fibres interrupted by occasional radial bands. The proboscidean nerve sheath appears to die out in this region of the proboscis, but if I am not mistaken it may be traced as far back as the level of the handle of the stylet (Fig. 16). Outside the thick layer of longitudinal muscles is a layer of large, irregular, highly granular and deeply staining cells (Figs. 15, 16, *gl. z.*). These evidently correspond to the layer of pigment granules described and figured by von Graff in the case of *Geonemertes chalicophora*, but I do not think that in our species they are actually pigmented although their highly granular character gives them a dark appearance under the microscope even in unstained preparations. Lines of granular material radiate inwards from these cells towards the handle of the stylet, and altogether they appear to be of

are not nearly so strongly developed. I have only been able to detect two thin muscular layers, an outer circular and an inner longitudinal. On the outer surface there appears to be as usual a low epithelium, but I have not succeeded in making it out at all clearly. Internally this portion of the proboscis is lined by a highly glandular, very darkly staining epithelium, which I have not been able to clearly differentiate from the darkly staining secretion which fills the lumen. At its posterior extremity the proboscis becomes very narrow and ends blindly. To the blind end is attached a strong bundle of long muscle fibres, the retractor muscle (Figs. 13, 14, *r. m.*), which has its origin on the inner surface of the dorsal wall of the proboscis sheath, a little in front of the blind ending of the latter. When the proboscis is retracted the retractor muscle is short and broad but it is obviously capable of great elongation.

It is, perhaps, hardly necessary to explain the mode of action of the proboscis any further than has been already done. Figure 14, taken from an actual dissection, represents the entire proboscis, with its retractor muscle, separated from the body and in a partially everted condition. It is hoped that reference to this figure will render further description unnecessary. The general view that the protrusion of the proboscis is effected by the powerful contraction of the muscles of the proboscis sheath, acting through the fluid which surrounds the proboscis, while withdrawal is effected by means of the retractor muscle, is doubtless correct. Probably the withdrawal is assisted by the contraction of the muscular diaphragm (Figs. 2-6, *m. d.*), already described, in connection with the anterior attachment of the proboscis to its sheath.

e. Circulatory and Excretory System.

The vascular system is very difficult to make out thoroughly, as, owing to the size and opacity of the body, it must be studied by means of serial sections. There are, as in *Geonemertes chalicophora*, three main longitudinal vessels, one (dorsal or median) lying between the proboscis sheath and alimentary canal, and one (lateral) on either side of the body in the neighbourhood of and ventral to the lateral nerve cords. I have not succeeded in demonstrating any connection between these vessels, unless the network of excretory tubules, to be described presently, be considered as such.

We will first describe the median or dorsal vessel. In the first place it does not keep by any means in the middle line, but is generally found to one side or the other and also curves about considerably. Generally, at any rate in the anterior portion of the body, it appears to keep constantly on one side of the middle line (Figs. 7, 8, *m. v.*)

The diameter of the vessel is by no means uniform. For perhaps the greater part of its length it is a narrow cylindrical tube, but occasionally, and more especially towards the anterior end, it swells out somewhat suddenly into a wide, irregular, lacunar cavity (Fig. 21). The structure of the wall of the vessel is decidedly complex. On the inside, in transverse sections, we see irregularly disposed, deeply staining nuclei (Fig. 22, *nu. v.*), usually projecting more or less into the lumen of the tube. From considerations to be adduced hereafter I doubt whether these are the nuclei of a properly defined epithelium. Outside this nucleated layer there comes a thin layer of very delicate fibres, doubtless muscular, arranged in a circular direction around the vessel (Figs. 22, 23, *c. m. v.*) Outside the muscular layer comes a single layer of large, vesicular-looking, irregularly ovoid, faintly staining cells with small nuclei and slightly granular contents (Figs. 22, 23, *ves. c.*) The wall of the vessel then, in its narrow portions, is made up of three distinct layers. In the swollen, lacunar portions of the vessel (Fig. 21, *l. m. v.*) only the two inner layers can be made out, the outer layer seems to be entirely wanting.

At its extreme anterior end the median vessel becomes narrow again, after swelling out into a series of irregular lacunæ as above described, and passes forward between the œsophagus and proboscis sheath to the level of the ventral commissure (Figs. 6, 18). Here it terminates in a very remarkable manner. A transverse section taken through the region of the ventral commissure will, if taken at exactly the right level, show two curious bodies imbedded in the proboscis sheath, one on each side of the mid-ventral line. These bodies have the form of cellular plugs, containing small, very deeply staining nuclei and frequently projecting very markedly into the cavity of the proboscis sheath. The exact form and position of one of these curious structures will be best understood by reference to Figure 18, representing a small portion of a longitudinal vertical section taken at one side of the median line. It will be seen that in its deeper part, as it passes through the muscular proboscis sheath, the

plug (*c. pl.*) forms a relatively narrow stalk, which seems to have a slightly fibrous structure. On reaching the cavity of the proboscis sheath it swells out into a rounded mass of cells, covered, I believe, with a flattened epithelium continuous with the epithelium which lines the proboscis sheath, and projecting into the rhynchocœlom.

The median vessel seems, according to my observations, to be connected with both of these cellular plugs. It appears to be directly continuous with the stalk of the one (Fig. 18) and to send off a branch to the other. Whether there is any constant distinction between the right and the left in this respect I am not able to say.

These cellular plugs appear to me to be probably vestigial structures, and to indicate two things—(1) a former more intimate connection of the median vessel with the proboscis sheath and the rhynchocœlom, such as at the present day exists in many marine Nemertines,* and (2) the former existence of a pair of vessels one on each side of the middle line beneath the proboscis sheath, instead of a single one as at present. Such a pair of vessels exists at the present day in what Oudemans† calls the "Palæo-type." I have been unable to determine whether the right or the left vessel constantly persists in *Geonemertes* or whether it is sometimes one and sometimes the other. Not expecting to meet with any distinction between right and left sides I did not take sufficient care in orientating my section series to justify me in forming a definite conclusion on the point in question. In other words, although the proper sequence of the sections has been rigidly maintained I am not absolutely certain that all the series have been mounted with the same side uppermost. It is some time since many of the sections were cut and I do not like to trust to my memory on such a point.

At its posterior extremity the median vessel is continued into a vessel of smaller diameter, which in histological structure presents a very interesting transition between the main median vessel and the network of excretory tubules to be presently described. A portion of this part of the median vessel is shown in Figure 20. It will be seen that the outer layer of large vesicular cells is absent and that

* *Vide* Oudemans:—"The Circulatory and Nephridial Apparatus of the Nemertea," *Quarterly Journal of Microscopical Science*, Vol. XXV., Suppl.

† *Loc. cit.*

the whole vessel closely resembles one of the excretory tubules with the addition of a thin layer—apparently discontinuous—of circular fibres around the outside.

The position of the two lateral vessels is shown in Fig. 8 (*l. v*) They are not so distinct and easily recognisable as the median vessel and never seem to attain to such complexity of histological structure. I have not been able to recognise either the circular muscles or the outer coat of vesicular cells in their walls and they seem even more like a specialised portion of the network of tubules to be described presently. Nuclei can be distinguished in their walls and occasionally the vessel dilates into irregular lacunæ (Fig. 23, *l. l. v.*) What happens to the lateral vessels at the anterior and posterior extremities I cannot say, but in the head region there are a number of wide, irregular lacunæ into which they probably open.

In sections which have been stained with Kleinenberg's hæmatoxylin a system of fine, apparently intra-cellular tubules (Figs. 7, 8, *ex. t*) is very distinctly visible, ramifying through all parts of the body between the muscle layers and the proboscis sheath. These tubules run in all directions and branch freely, but they are especially developed in the region of the body above the proboscis sheath and they generally, though by no means always, run in a direction at right angles to the long axis of the body, forming a series of irregular loops curving over the proboscis sheath from side to side. They are also to be found running transversely beneath the alimentary canal. As already stated they branch freely and some of the branches run in the direction of the long axis of the body. These tubules open into the lateral vessels (Fig. 23) and probably also into the median one. I have not been able to demonstrate any opening of the tubules into the latter but they can be traced very close to it and the transitional condition of the median vessel at its posterior end in regard to histological structure is indicative of a close connection between it and the network of tubules. The histological structure of the tubules (Fig. 19) points to an intra-cellular nature. They are very narrow and at fairly regular intervals present very distinct swellings. Each of the swellings is caused by the presence of a nucleus which curves partially round the tubule and which stains very darkly with hæmatoxylin, thus rendering the tubules very conspicuous in sections. Sometimes the tubules appear to be empty and sometimes they appear to be filled with a

granular substance. The wall of the tubule between the nuclei is visible as a fine, highly refractive outline.

Although they are such obvious and definite structures in properly stained preparations it is by no means easy to decide upon the true nature of these intra-cellular tubules. The position of the main branches and the connection with the lateral vessels suggests that the former are the homologues of the transverse vessels of other Nemertines. Their histological structure and much branched character suggests that they are excretory in function. The excretory system is so intimately connected with the vascular system in other Nemertines that I am inclined to believe that both these suggestions may be correct.

So far as I am aware no excretory system has yet been described in land Nemertines, and it seems not impossible that in *Geonemertes* the same system of vessels is both excretory and circulatory. Apparently the longitudinal vessels are merely specialised portions of the network of tubules, being similar tubes with the addition in some places of fine circular fibres and an external layer of vesicular cells. Hence I believe the lumen of the longitudinal vessels to be probably intra-cellular.

The great objection to considering the network of tubules as excretory is the apparent absence of any opening whatever to the exterior. In other Nemertines such as *Polia* the excretory pores are easily visible, and in the genus mentioned I have had no difficulty in finding them in transverse sections. Did such distinct openings to the exterior exist in *Geonemertes* I hardly think that I could have overlooked them. It is, however, very possible that smaller openings exist which I have either overlooked entirely or failed to distinguish from the numerous genital apertures to be described presently.

For a long time, also, I could detect nothing of the nature of flame-cells in *Geonemertes*, which one would certainly expect to find in connection with such a system of excretory tubules as I have described. Had I relied solely on my sections I should probably never have found flame-cells at all, but in examining a crushed preparation of the living worm I was fortunate enough to find a beautiful flame-cell in full activity. This is represented in Figure 26, as it appeared in optical section while alive. It will be seen that at one end of the cell there is a triangular projection of denser and clearer looking protoplasm; the swollen middle

portion of the cell is highly granular, and at the other end is a deep pit or excavation, in the bottom of which the flame-like undulating structure (*fl.*) is inserted.

I was able to observe the movements of the "flame" for a considerable time, until they gradually slackened and then ceased. They were extremely beautiful and characteristic, consisting of a series of undulations passing from base to apex in rapid succession and causing the "flame" to exhibit alternate light and dark bands which travelled rapidly along it and at first sight conveyed the impression of successive bubbles of gas escaping from the end of a tube under water.

Probably the flame is made up of a bundle of long cilia, but I could not satisfy myself on this point, although faint indications of longitudinal striations were visible in it.

This cell, I have no doubt, formed the termination of a branch of the system of intra-cellular tubules described above, but I could not trace this system in the living animal owing to the thickness of the specimen and the opacity of the tissues, and it was only by good luck that I found a flame-cell at all in a crushed preparation. As far as I am aware flame-cells have never hitherto been observed in Nemertines except perhaps in the American fresh water species, *Tetrastemma aquarum dulcium*, described by Silliman.* As far as I can gather from that author's description, flame-cells appear to be present, at any rate there are structures which he calls "Flimmer-läppchen" at the ends of narrow branches of the excretory system, but the description of the excretory system is very meagre and unaccompanied by illustrations. As the excretory system of this species appears to agree more closely with that of our *Geonemertes* than that of any other known Nemertine, I may perhaps be allowed to quote it in this place for the sake of comparison :—"Das Wassergefässsystem dieser Art ist sehr leicht zu verfolgen. . . . . . Es scheinen in der Regel zwei selbständige Längsstämme vorhanden zu sein, die sich unter der Leibeswand reichlich verzweigen, besonders im Kopftheile und auf dem Rüssel. Die Ausmündungsporen liegen auf der ventralen Fläche gegen die Mitte der Körperlänge. Die Bewegung der Flüssigkeit wird von den Flimmerläppchen, die in dem erweiterten Ende der kapillaren Zweige sich finden, erhalten." It seems to me very probable that the "Längsstämme" here mentioned may be homologous with

* Zeitschrift für wissenschaftliche Zoologie, Vol. 41, 1885, p. 70.

the lateral vessels of *Geonemertes*, although I have been able to find no external openings in the latter.

There are so many points connected with the circulatory and excretory system of Nemertines still involved in obscurity, that I may well be excused from attempting to give a complete explanation of the structures described above. I would merely suggest as a possible working hypothesis that in *Geonemertes* the excretory and circulatory systems are even more closely related than usual, being in fact represented by one and the same system of vessels, and that *possibly* there are no external excretory openings.

Figures 19 to 23 illustrate the histological structure of various parts of the vascular and excretory systems as seen in sections, and will, it is hoped, sufficiently justify the statements made above as to the form and structure of these parts. For the convenience of comparison all these figures are drawn to the same scale. Figure 26, as already observed, was drawn from life.

It is obvious that the excretory system of *Geonemertes* differs very strikingly from that of marine forms, and it is especially remarkable that it differs even more from that of its marine allies in the group *Enopla* than from that found in the *Anopla*, for, according to Bürger,* the blood-vessels in the marine *Enopla* form no dilatations nor capillaries, and he could find no connection between the blood-vessels and the excretory organs.

f. Nervous System

The nervous system does not, so far as I have been able to make out, present any striking peculiarities, and a brief description of it will therefore suffice. At the anterior end of the body, immediately behind the muscular diaphragm already noticed, is situated the brain, or cerebral ganglionic mass (Figs. 2, 3, 4, 5, 7). This consists of the usual four lobes found in Nemertines, two on each side of the extreme anterior end of the proboscis sheath. One of the two lobes of either side is larger than the other and is also more dorsal and more anterior in position; we may call it the dorsal lobe of the ganglion (Figs. 3, 4, 5, 7, *d. g.*) The other, smaller lobe of each side is more posterior and ventral and may be called the ventral lobe of the ganglion (Figs. 2, 3, 4, 5, 7, *v. g.*) The right and left ventral lobes are connected together by a

* *Loc. cit.*

stout commissure which runs beneath the proboscis sheath and above the œsophagus and which we may call the ventral commissure (Fig. 6, *v. c.*) The right and left dorsal lobes are similarly connected by a slenderer commissure—the dorsal commissure (Fig. 6, *d. c.*)—which runs above the proboscis sheath. In this way a complete ring is formed around the proboscis sheath. The two ventral ganglia are continued posteriorly into the lateral nerve cords (Figs. 2, 8, 24, 25, *n. c.*) These lie one on each side of the ventral aspect of the body, within the layer of longitudinal muscles (Fig. 8); they run straight to the posterior end of the body, where they unite together above the intestine just in front of the anus.

Various nerves are, of course, given off from the central nervous system thus constituted, but these I have not attempted to work out in detail and, indeed, to do so would, owing to the minute size of the animal, be a very difficult matter. The most conspicuous of these nerves are those which come off from the antero-ventral aspects of the dorsal lobes of the cerebral ganglia (Figs. 4, 5, *n.*) It will be seen from Figure 4 that a specially large trunk leaves the brain just above the ganglion of the lateral organ, and divides into a number of branches, some of which run antero-dorsally and probably supply the eyes, while another runs straight to the sac on the lateral organ and yet another runs backwards and somewhat ventralwards and divides into two short branches, whereof one runs to the posterior end of the ganglion of the lateral organ and the other to the curious œsophageal organ marked *x.* in the figures.

The histological structure of the central nervous system bears a marked resemblance to that of the same organs in *Geoplana*,* but the small nerve-cells are more abundantly developed and more definitely arranged. In the brain they occur abundantly in the outer portion of each lobe, leaving the interior free from their presence. In the lateral nerve cords the nerve cells are arranged in a very characteristic manner, as already described by von Graff in the case of *Geonemertes chalicophora.* They are aggregated in two bands, one on the ventral aspect of the nerve cord and one on the dorsal aspect, but above the dorsal band of nerve cells there is a narrow band of fibrous tissue. This characteristic arrangement of the nerve cells in the lateral cords is best shown in Figs. 2 and 25, (*n. c.*)

* *Cf.* Dendy, "Anatomy of an Australian Land Planarian," Trans. Royal Soc., Victoria, 1889.

g. The Lateral Organs.

By way of preface to this portion of our subject, I will take the liberty of quoting part of Professor Hubrecht's concise and excellent account of the lateral organs given in his article on Nemertines in the latest edition of the *Encyclopædia Britannica*:—

"This apparatus is usually known under the name of the "lateral organs. To it belong (*a*) superficial grooves or "deeper slits situated on the integument near the tip of the "head, (*b*) nerve lobes in immediate connection with the "nervous tissue of the brain, and (*c*) ciliated ducts penetrat-"ing into the latter and communicating with the former. "Embryology shews that originally these different parts are "separately started, and only ultimately become united into "one. Two lateral outgrowths of the foremost portion of "the œsophagus, afterwards becoming constricted off, as "well as two ingrowths from the epiblast, contribute "towards its formation, at least as far as both Hoplo- and "Schizonemertines are concerned. . . . These posterior "brain-lobes, which in all Schizonemertines are in direct "continuity of tissue with the upper pair of principal lobes, "cease to have this intimate connexion in the *Hoplonemertea;* "and, although still constituted of (1) a ciliated duct, opening "out externally, (2) nervous tissue surrounding it, and "(3) histological elements derived from the œsophageal "outgrowths, they are nevertheless here no longer constantly "situated behind the upper brain lobes and directly "connected with them, but are found sometimes behind, "sometimes beside, and sometimes before the brain-lobes. "Furthermore, they are here severed from the principal "lobes and connected with them by one or more rather thick "strings of nerve-fibres. In some cases, especially when the "lobes lie before the brain, their distance from it, as well as "the length of these nervous connexions, has considerably "increased. . . . With the significance of these parts we "are still insufficiently acquainted. . . . Whether in the "Hoplonemertines, where the blood fluid is often provided "with hæmoglobiniferous disks, the chief functions of the "side organs may not rather be a sensory one must be "further investigated."

This I take to be a fair summary of our knowledge of the lateral organs* up to the present time, and I will now

* For further details as to the marine forms the reader is referred to Bürger's excellent memoir already referred to.

proceed to describe the condition of the parts concerned in *Geonemertes australiensis.*

In the first place the lateral organ of each side lies almost entirely below the brain, as will readily be seen by reference to Figure 4.

On the ventral surface of the head there is a slight transverse groove (Figs. 5, 6, 12, *gr.*) in which lie, one on either side of the mid-ventral line, the openings of two narrow and deep pits—the ciliated ducts* or cephalic pits. Following one of the ducts (Fig. 4, *c. p.*) inwards from the external opening we find that it passes obliquely upwards and backwards and, at the same time, towards the side of the body, so that in Figure 5 it appears cut transversely. When it reaches the level of the anterior surface of the brain the duct runs into the substance of a dense mass of small-celled tissue (Fig. 4, *l. g.*) This is evidently the epiblastic portion of what Hubrecht calls the posterior brain-lobe, but here no longer posterior and also widely separated from the rest of the brain. From its position and relations I propose to call this part the "ganglion of the lateral organ."

The ganglion of the lateral organ is an elongated mass of densely packed, small cells, lying longitudinally beneath the anterior and dorsal lobe of the brain. It is somewhat bent upon itself and narrows posteriorly. Near its hinder end it receives the nerve from the brain already mentioned, which joins it on its dorsal aspect just as it passes through the muscular diaphragm. At its posterior extremity the ganglion of the lateral organ becomes continuous with the curious body marked *x.* in Figs. 3, 4, 5, 7. This body I take to be the œsophageal portion of the lateral organ mentioned by Hubrecht, and as it is clearly distinguishable from the remainder of the lateral organ, I propose to call it the "œsophageal organ." The œsophageal organ is very different in histological structure from the ganglion of the lateral organ. It is composed of much larger, nucleated, granular, very darkly staining cells, closely packed together into a dense mass which runs beneath and behind the ventral lobe of the brain (Fig. 4). Its appearance suggests that it may possibly be glandular, but for the present I fear it must be regarded as an organ of unknown function. Figure 4 shows that it

* I have not been able to detect the cilia in my sections except just by the external opening.

lies in close proximity to the œsophagus in the adult animal, and this position, taken together with its histological structure, leaves little doubt in my mind as to its homology with the portion of the lateral organ derived from the œsophagus in other Nemertines. It receives at its anterior end, as already stated and as shown in Fig. 4, a special nerve from the dorsal lobe of the brain, or, to speak more accurately, a branch of the same nerve which supplies the ganglion of the lateral organ.

We must return now to the consideration of the ciliated duct, or cephalic pit, which we left just as it was entering the ganglion of the lateral organ. At this point it divides into two branches (Fig. 4). One of these branches penetrates through the middle of the ganglion of the lateral organ and thence enters the substance of the œsophageal organ, where it disappears; its course is represented by the dotted red line in Fig. 4.

The other branch of the duct turns outwards and, passing in front of the ganglion of the lateral organ, dilates into a relatively large, hollow, laterally compressed vesicle (Figs. 2, 3, 4, *sac*). The wall of this sac or vesicle is composed of a single layer of large, columnar, nucleated cells, chiefly remarkable for their bright yellow colour. The inner end of each cell, towards the cavity of the sac, shows indications of being cuticularized and forms a slight, obtuse projection. Such a saccular diverticulum of the ciliated duct appears, according to Bürger, to be very characteristic also of the marine *Enopla*. Possibly, as Bürger suggests, it is sensory in function.

h. The Eyes.

Geonemertes australiensis differs from all previously described land Nemertines in the possession of a large and indefinite number of eyes, all the previously described species having either four or six. These eyes, of which there may be as many as thirty or forty in our species, are arranged in two groups (Fig. 12, *e. g.*), one on either side of the opening of the rhynchodæum at the anterior extremity of the body. Each group, containing about twenty eyes of various sizes, may show indications of a division into an anterior and a posterior portion, the eyes in the anterior portion being on the average larger than those in the posterior. Whether this is a constant arrangement or not I cannot say, but it suggests that the numerous

eyes of *G. australiensis* may have been derived by subdivision of four eyes, two larger anterior and two smaller posterior, such as we find in *G. chalicophora*. Sometimes the eyes in our species appear more or less elongated and sometimes even dumb-bell shaped, which seems to indicate that they multiply by division.

In its minute structure each eye agrees in the main with the eye of *Drepanophorus rubrostriatus* as figured by Bürger,* but I have not been able to make out so much histological detail as that observer. Each eye (Figs. 11, 11*a*) has the form of a deep cup whose opening is turned towards the surface of the body. The wall of the cup is made up of a layer of elongated columnar rods, the inner ends of which, next to the cavity of the cup, are perfectly clear and transparent, while their outer ends are filled with pigment granules. In *Drepanophorus*, on the other hand, the pigment is stated to lie not in the rods themselves but in pigment cells situated behind them. There is also a layer of nucleated cells behind (outside of) the pigmented ends of the rods in *Geonemertes* (Fig. 11) but this appears merely to form a kind of capsule whose cells are perhaps also more or less pigmented. The cavity of the optic cup is filled with a non-staining material which in transverse sections appears finely and regularly granular (Fig. 11*a*). In front of the opening of the cup lies the optic ganglion (Fig. 11, *op. g.*), from which extremely delicate fibrils run down into the cavity of the cup, doubtless to become connected with the inner ends of the rods, as in *Drepanophorus*. The nuclei of the ganglion cells are very easy to make out but not so their protoplasmic bodies. I have not succeeded in tracing the optic ganglion into connection with the nerves given off from the dorsal lobes of the cerebral ganglion (Fig. 4, *n.*) but doubtless such a connection exists as in other Nemertines.

The colour of the eye-pigment is black in the living worm and on the addition of dilute hydrochloric acid it turns to a rich reddish brown colour and partially dissolves.

i. Connective Tissue, Glandular Structures, &c.

The connective tissue, which fills all the interspaces between the various internal organs, agrees very closely with what has been described in other Nemertines. It consists of an almost perfectly hyaline, transparent, non-

* *Loc. cit.* Plate VI. Fig. III.

staining ground substance, resembling closely the ground substance of the mesoderm in Cœlenterata, in which various kinds of cells are imbedded. The most characteristic of the imbedded cells are small, irregularly shaped, finely granular, nucleated masses of protoplasm (Fig. 24, *gr. c.*) which either occur singly or in irregular groups resembling syncytia. These cells are very abundant above and at the sides of the proboscis sheath and also below the alimentary canal. their appearance suggests that they may be amœboid but this of course requires proof.

We also find numerous cells greatly elongated so as to form delicate fibres, but with the nucleus still clearly visible in the middle. These are readily distinguishable in the region between the proboscis sheath and alimentary canal, where the gelatinous-looking ground substance is very strongly developed and contains comparatively few cells. Frequently these cells branch, and I believe they form networks like the stellate mesodermal cells of sponges, which they closely resemble.

Occasionally the gelatinous-looking ground substance appears to be replaced by a close network of very delicate, non-nucleated, transparent fibrils, but this I am inclined to regard as a post-mortem condition due to the method of preparation.

We may mention in this place certain structures which occur imbedded in the ground-substance and which we have not yet had occasion to refer to.

(1) *The Cephalic Gland* (Fig. 7, *c. gl.*).—This consists of a curious mass situated in the head region dorsally and laterally, overlying the proboscis sheath and dorsal lobes of the ganglia, inside the layer of longitudinal muscles. It consists of a number of large, irregular, granular masses, closely packed together. Each mass appears to be made up of a large number of small cells, for each contains numerous small nuclei and sometimes cell divisions can be clearly distinguished. The cephalic gland stains deeply with hæmatoxylin but only slightly (except the small nuclei) with borax carmine and acid alcohol. I have not been able to make out any definite ducts leading to the exterior, but the appearance of my sections leads me to believe that the secretion is passed out through extemporised channels over the back and sides of the head.

Gulliver describes* and figures a "cephalic glandular

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* Philosophical Transactions of the Royal Society of London, Vol. 168, 1879, p. 557, *et seq*, Plate LV.

mass" in *Tetrastemma rodericanum*, which apparently closely resembles that of *Geonemertes australiensis*, while a similar gland appears, according to Bürger, to be frequently met with in marine Nemertines.

(2) *Dorsal Glands* (Fig. 6, *d. gl.*)—These consist of very numerous small cells arranged typically in pear-shaped clusters beneath the layer of longitudinal muscles on the dorsal surface, the narrow end of each cluster or bunch of cells pointing outwards. These cells are most abundantly developed in the anterior portion of the body, just behind the head, and are met with only occasionally and in small groups towards the posterior end. The individual cells are characterised by staining very deeply with borax carmine. Each has the form of a somewhat egg-shaped sac with the narrow end pointing outwards. In my preparations the granular cell-contents appear frequently to have shrunk down into the bottom or broad end of the sac, where also the nucleus is situated. In hæmatoxylin preparations the sacs often appear almost empty save for a darkly staining mass lying in the bottom and looking like a local thickening of the sac wall.

(3) *Calcareous Bodies.*—These are clearly visible under the microscope in crushed preparations of the living worm but, curiously enough, I have altogether failed to identify them in my stained sections. They lie beneath the integument and between the lobes of the alimentary canal. They are oval, often irregular, colourless bodies, about 0·028 mm. in diameter and somewhat resembling starch grains in appearance. They do not, however, stain blue with iodine. Under the action of caustic potash they do not swell perceptibly but become very distinct and exhibit a differentiation into an outer wall and a more or less granular contents. Osmic acid does not stain them and alcohol does not dissolve them, at any rate in a short time. They appeared to be unaffected by weak hydrochloric acid so long as I had them under continued observation, but a preparation after prolonged treatment with pretty strong hydrochloric acid (perhaps 15 minutes) no longer shewed them.

From these results I conclude that the bodies in question probably consist of an organic basis more or less impregnated with carbonate of lime.

Von Graff describes somewhat similar bodies in *Geonemertes chalicophora.* They appear to be of about the

same size but are flat, and occur in the skin, where they seem to take the place of the rod-like bodies of other forms. Von Graff states that they are mainly composed of carbonate of lime.

I have found no rod-like bodies in *Geonemertes australiensis.*

k. Reproductive Organs.

Bürger* commits himself to the generalisation that terrestrial Nemertines are hermaphrodite, which is somewhat remarkable inasmuch as of the four hitherto described forms two, viz. *Tetrastemma agricola* and *T. rodericanum*, are distinctly stated to have the sexes distinct. In *Geonemertes australiensis* also we find distinct males and females.

Females would appear to be much commoner than males, for I have only found one of the latter amongst the considerable number which I have examined microscopically. The single male observed, although sexually mature, was considerably below the average size; but females of equally small size also occur, so that it is impossible to found any generalisation as to difference in size of the sexes upon this fact. I have detected no other difference between the two sexes except in the reproductive organs themselves.

In the female (Fig. 24) we find ova in various stages of development irregularly and thickly scattered along the sides of the body, above the lateral nerve cords and beneath the muscular layers of the body wall. Their arrangement appears to bear no definite relation to that of the diverticula of the alimentary canal, which is also irregular.

The ova, from a very early stage in their development, are enclosed separately in special capsules (Fig. 24, *c. ov.*), which open to the exterior along the sides of the body by means of narrow ducts (Fig. 24, *sp. d.*) which pierce the different layers of the body wall. The wall of the duct is merely a continuation of the capsule, and around its point of union with the latter there is a large, placenta-like thickening, as shown in the figure. This thickened portion of the capsule is composed of a mass of small, granular, nucleated cells, whose boundaries are extremely difficult to recognise. Probably the cells of the capsule, and especially those of the thickened portion, aid in the nutrition of the growing ovum,

* *Op. cit.*, p. 260.

which attains a very large size before reaching maturity. The most remarkable fact about the capsule is that in life, as seen on examining crushed preparations, it has a very distinct green colour, strongly suggestive of the presence of chlorophyll. The ovum itself is colourless, but is seen to be surrounded by a capsule composed of numerous small, yellowish-green, granular masses. This I carefully observed in two living specimens from different localities. Whether or not chlorophyll is really present I am unable at present to say, but judging from the analogy of *Convoluta* it seems not altogether impossible. A very tempting field for speculation is thus opened, but until we know whether the green colouring matter is really chlorophyll or some other substance it is perhaps best to keep silence.

The ova, as already stated, grow to a very large size, measuring up to about 0·6 mm. in diameter. It seems to me almost impossible that they should be discharged through the narrow, preformed genital ducts. I believe that they escape by rupture of the body wall and that the ducts merely serve to convey spermatozoa to them. That these ducts do so convey the spermatozoa I conclude from the fact that I have found spermatozoa in them. Probably the process of fertilization is effected by the male crawling over the female and passing out the sperm as he crawls.

The reproductive organs of the male (Fig. 25) are found in the same position as those of the female, namely along the sides of the body above the lateral nerve cords. They also bear, at any rate when mature, a striking resemblance to those of the female in structure. In the earlier stages of their development, however, I have only been able to find irregular masses of sperm-mother-cells in various stages of division (Fig. 25, *sp. m. c.*), without, so far as I could see, any distinct capsule or genital duct. Later on, however, we find densely packed, rounded masses of spermatozoa (Fig. 25, *te.*) each enclosed in a very delicate capsule, which opens to the exterior through a slender duct (Fig 25, *v. d.*) exactly as in the female. After the spermatozoa have been discharged the capsule is still recognisable as a shrunken bag (Fig. 25, *te. ca.*) in whose thin wall nuclei are distinctly visible, and this bag appears simply as a large dilatation on the inner end of the genital duct. The testes are, like the ovaries, extremely numerous, and occur thickly scattered along the sides of the body. As to the origin of the ova and spermatozoa I have

no definite observations to record, and can only suggest that they are developed from the granular mesodermal cells (Fig. 24, *gr. c.*) which are very abundant in the neighbourhood of the reproductive organs.

5. Summary.

On comparing the foregoing account of the minute anatomy of *Geonemertes australiensis* with Bürger's already often quoted researches on the marine Nemertea, and especially the marine *Enopla*, it will be seen that the marine and terrestrial forms agree very closely in structure. The most striking and important difference concerns the excretory system, which, in *Geonemertes*, consists of a system of intra-cellular tubules terminating in flame-cells. The circulatory system, moreover, appears to be merely a specialised portion of the excretory system.

Only four species of land Nemertines have hitherto been described, viz.:—*Geonemertes palaensis*, Semper; *G. chalicophora*, von Graff; *Tetrastemma agricola*, von Willemoes-Suhm, and *T. rodericanum*, Gulliver. From all these *Geonemertes australiensis* differs widely, the most striking difference being, perhaps, the large and indefinite number of eyes.

The principal characteristic features of *Geonemertes australiensis* are as follows:—

Animal about 40 mm. long and 2·5 mm. broad when crawling. Colour chiefly yellow, sometimes with a darker median dorsal band of brown. Eyes numerous, about forty, arranged in two main groups one on each side of the head. Lateral organs well developed, opening on the ventral surface of the head in front of the brain by small round apertures sometimes (? always) placed in a transverse groove. No rod-like bodies in the skin, but irregularly oval, calcareous bodies in the deeper tissues. Mouth opening into the rhynchodæum. Sexes distinct. Cephalic gland well developed, but with no conspicuous external opening. Excretory system consisting of branching intra-cellular tubules, provided with flame-cells and connected with the circulatory system. The remainder of the anatomy closely resembles that of the marine *Enopla*. Found under logs and stones in Australia.

6. Description of Plates.

Geonemertes australiensis.

Plate VII.

Fig. 1.—Living specimen with the proboscis everted. Dorsal surface. Painted from life. × $2\frac{1}{2}$.

Figs. 2–5.—Selected from a series of vertical longitudinal sections through the anterior end (stained with borax carmine.) All from one and the same side of the middle line, Fig. 2 being nearest to the outside and Fig. 5 nearest to middle line, to show the brain, lateral organs, eyes, &c. In Fig. 4, which passes through about the middle of one-half of the brain, that portion of the cephalic pit which is not actually visible in the section is represented by a red dotted line. The muscular diaphragm is shown in all the figures and sufficient of the longitudinal muscle sheath to show its connection with the latter. All drawn under Zeiss A, oc. 2, camera outline.

al. c. Alimentary canal.
c. p. Cephalic pit.
d. g. Dorsal lobe of cerebral ganglion.
e. Eye.
ep. Epidermis.
gr. Groove in which openings of cephalic pits lie.
l. g. Ganglion of lateral organ.
l. m. Layer of longitudinal muscles.
l.′ m.′ Forward continuation of longitudinal muscle layer in front of the muscular diaphragm. (Portion only shown).
m. d. Muscular diaphragm.
m. v. Median vessel.
n. Nerves coming off from cerebral ganglion.
n. c. Lateral nerve cord.
p. s. Proboscis sheath.
sac. Sac of lateral organ.
v. g. Ventral lobe of cerebral ganglion.
x. Œsophageal organ.

Plate VIII.

Fig. 6.—Median longitudinal vertical section through the anterior end, from the same series and drawn to the same scale as Figures 2–5.

b. m. Basement membrane.
c. gl. Cephalic gland.
c. m. Layer of circular muscles.
c. o. Common opening of mouth and proboscis sheath (=opening of rhynchodæum).
d. c. Dorsal commissure of brain.
d. gl. Dorsal glandular organs.
d. gut. Forward diverticulum of the gut, passing beneath the œsophagus.
ep. p. s. Epithelium lining proboscis sheath.
gut. Gut proper.
m. Mouth.
m. p. Ruptured muscular attachment of the proboscis to the anterior end of the proboscis sheath.
œs. 1. First, narrow portion of œsophagus.
œs. 2. Median, dilated portion of œsophagus.
œs. 3. Last, narrow portion of œsophagus.
v. c. Ventral commissure of brain.

(Other lettering as before).

Fig. 7.—Transverse section of a specimen stained with hæmatoxylin, taken just behind the cerebral commissures, to show especially the cephalic gland. Drawn under Zeiss A, oc. 3, camera outline. The proboscis being everted the non-eversible portion is seen in section inside the proboscis sheath.

ex. t. Excretory tubules.
p. Proboscis.

(Other lettering as before).

Fig. 8.—Transverse section near the middle of the body. From the same series as Fig. 7. The inequality in thickness of the proboscis sheath is due to irregular contraction. The ovaries happen to be very small in this section. Drawn under Zeiss A, oc. 2, camera outline.

l. v. Lateral vessel.
ov. Ovary.

(Other lettering as before).

FIG. 9.—Small portion of a longitudinal vertical section through the skin and muscle-layers in the ventral region of the body (borax carmine). Drawn under Zeiss F, oc. 2.

gl. c. Sub-epidermic gland-cells.

nu. Nuclei scattered about between the inner ends of the epidermic cells.

o. m. Layer of oblique or diagonal muscle fibres.

(Other lettering as before).

FIG. 10.—Small portion of a tangential longitudinal section passing on the left through the layer of longitudinal muscles, in the middle through the layer of oblique (diagonal) muscles, and on the right through the layer of circular muscles. Drawn under Zeiss D, oc. 2.

(Lettering as before).

FIG. 11.—Longitudinal section of an eye and optic ganglion. From a specimen stained with borax carmine. Drawn under Zeiss F, oc. 2.

op. g. Optic ganglion.

FIG. 11A.—Transverse section of an eye, from a specimen stained with borax carmine. Drawn under Zeiss F, oc. 2.

Plate IX.

FIG. 12.—Ventral view of a specimen from Walhalla preserved in spirit, with the proboscis everted and torn away from its anterior attachment. × 3.

a. Anus.

a.′ a.′ Line along which the proboscis has been torn away from its anterior attachment.

e. g. Group of eyes.

(Other lettering as before).

FIG. 13.—Specimen with the proboscis retracted, dissected from the dorsal surface by slitting open the proboscis sheath longitudinally and pulling the contained proboscis to one side. × 3½.

a. a. Anterior attachment of proboscis to proboscis sheath (compare Fig. 6, *m. p.*)

p. a. Posterior attachment of proboscis (by its retractor muscle), to the proboscis sheath.

r. m. Retractor muscle of proboscis.

FIG. 14.—A semi-everted proboscis detached from the proboscis sheath and with the everted portion slit open to show the non-everted portion lying within.

e. r. Eversible region of the proboscis.
st. r. Stylet-region.
n. e. r. Non-eversible region.

(Other lettering as before).

FIG. 15.—Longitudinal section through the stylet-region of the proboscis. Drawn under Zeiss A, oc. 3.

c. st. Central stylet.
gl. p. Glandular papillæ of the eversible region.
gl. z. Zone of glandular cells.
h. "Handle" in which the central stylet is fixed.
p. d. Poison duct, leading up to the base of the central stylet.
p. r. Poison reservoir in the posterior half of the stylet-region.

(Other lettering as before).

FIG. 16.—Transverse section through a partially everted proboscis. The section passes through the "handle" of the stylet, which is seen in the middle, and the outer portion of the section shows the eversible portion of the proboscis turned inside out and surrounding the stylet-region. Drawn under Zeiss A, oc. 3, camera outline.

e. c. m. External circular muscles of the everted portion of the proboscis.
e. l. m. External longitudinal muscles of the same.
i. c. m. Internal circular muscles of same.
i. l. m. Internal longitudinal muscles of same.
p. n. s. Proboscidean nerve sheath.
s. r. s. Sac containing reserve stylets.

(Other lettering as before).

FIG. 17.—A sac containing reserve stylets, from an unstained preparation. Drawn under Zeiss D, oc. 2, camera outline.

a. st. Abnormal stylet.
st. m. c. Stylet mother cell with commencing stylet.

FIG. 17*a*.—A single stylet, drawn under the same conditions.

FIG. 17*b*.—Head of a stylet, seen end on, drawn under the same conditions.

FIG. 17*c*.—Probable mother cell of a stylet, from one of the reserve sacs, drawn under the same conditions.

FIG. 18.—Small portion of a section from the same series as Figs. 2–6, taken a little to one side of the middle line, between the sections represented in Figs. 5 and 6; to shew the curious cellular plug in connection with the median vessel and projecting into the cavity of the proboscis sheath. Drawn under Zeiss D, oc. 2, camera outline.

c. pl. Cellular plug.

(Other lettering as before).

Plate X.

FIG. 19.—Portion of the system of excretory tubules, from above the proboscis sheath in a transverse section stained with hæmatoxylin. Drawn under Zeiss F, oc. 2.

FIG. 20.—Posterior portion of median vessel, as seen in longitudinal section stained with hæmatoxylin. Zeiss F, oc. 2.

cr. Concretion (?) within the vessel.

FIG. 21.—Portion of median vessel seen in a transverse section stained with hæmatoxylin, shewing one of the lacunar dilatations. Zeiss F, oc. 2.

c.m.v. Circular muscle fibres around the vessel.

l.m.v. Lacunar dilatation of the vessel.

nu. v. Nuclei of the inner wall of the vessel.

ves. c. Vesicular cells outside the vessel.

FIG. 22.—Transverse section of the median vessel. Zeiss F, oc. 2.

(Lettering as before).

FIG. 23.—A lacuna on the lateral vessel with an excretory tubule opening into it. From a transverse section stained with hæmatoxylin. Zeiss F, oc. 2.

l. l. v. Lacuna on the lateral vessel.

(Other lettering as before).

FIG. 24.—Portion of a transverse section of a fe specimen, stained with borax carmine, to s the reproductive organs. Zeiss D, oc. 2, car outline.

c. ov. Capsule of ovum.

f. g. o. Female genital opening.

gr. c. Granular nucleated cells lying in the gelati ground substance.

n. ov. Nucleus of ovum.

s. ep. Sub-epidermic glandular layer.

sp. d. Duct through which the spermatozoa reach ovum.

(Other lettering as before).

FIG. 25.—Portion of a transverse section of a male specin stained with borax carmine, to show the re ductive organs. Zeiss D, oc. 2, camera.

m. g. o. Male genital opening.

sp. m. c. Mass of developing sperm-mother-cells.

te. Testis full of spermatozoa.

te. ca. Shrunken capsule of a testis from which spermatozoa have apparently escaped.

v. d. Vas deferens.

(Other lettering as before).

FIG. 26.—Flame cell. Drawn from crushed preparatio living specimen under Zeiss F, oc. 2.

fl. The flame-like, vibratile bunch of cilia, alternate light and dark bands caused b undulatory movement.

Art. XVI.—*Descriptions of some Land Planarians from Queensland.*

(Plate XI.)

By Arthur Dendy, D.Sc.

[Read November 12, 1891.]

The specimens described in the present communication were collected by Professor W. Baldwin Spencer, M.A., on his recent expedition to Southern Queensland in September and October 1891, and kindly placed in my hands in a living condition for purposes of description. There were six species represented in the collection, and these belonged to no less than three genera, viz., *Geoplana* (four species); *Rhynchodemus* (one species); and *Bipalium* (one species, probably introduced). Only two of the species are new to science, but one of these, *Geoplana regina*, is a remarkably handsome worm. The other species are already known from the adjoining colony of New South Wales. As might be expected, the species altogether show a much closer relationship to those of New South Wales than to those of Victoria. Professor Spencer informs me, however, that the Planarian fauna was not nearly so rich in the localities visited by him as it is in many parts of Victoria.

1. *Geoplana cœrulea*, Moseley.*

This well-known species, the first ever described from Australia, was met with in abundance, some of the specimens measuring as much as 110 mm. in length by 2·5 mm. in greatest breadth when crawling. The shape of the body varied considerably in the living animal, the dorsal surface being sometimes flattened, sometimes simply convex, and sometimes strongly ridged, as in the closely allied Victorian

* "Notes on the Structure of several Forms of Land Planarians, &c." *Quarterly Journal of Microscopical Science*, Vol. XVII, N.S., p. 285.

species *G. dendyi*, Spencer. The peripharyngeal aperture (in spirit) is in about the middle of the ventral surface, sometimes a little anterior, and the genital aperture is situate at about one-third of the distance from it to the posterior extremity. The eyes are arranged in a densely crowded irregular patch on each side of the head and continued in single series all round the horse-shoe-shaped anterior margin. The ground colour of the dorsal surface (in life) ranged from pale indigo-blue to dark grey, blue-brown or almost black. The mid-dorsal yellow stripe was sometimes so pale as to be almost white, and frequently there was visible on each side an ill-defined dorso-lateral band of a lighter tint of the ground colour, dividing each half of the dark dorsal surface into a broader (more dorsal) and a narrower (more ventral) band. The anterior extremity was pinkish, although sometimes the pink colour was scarcely recognisable. The ventral surface was bright blue, lighter in the middle line than elsewhere.

Localities.— Gympie (Mary River); Burnett River; Cooran.

2. *Geoplana variegata*, Fletcher and Hamilton.*

(Plate XI, Fig. 2.)

This very handsome species was obtained by Professor Spencer in large numbers and would seem to be the commonest species in the district visited by him. The body is long and narrow, even when lying still and coiled into a knot; tapering a good deal more gradually in front than behind. The shape of the dorsal surface varies from more or less flattened to strongly ridged, according to the position of the animal; it may be said to be characteristically ridged, as shown in the figure. The worm reaches a very large size. The largest specimen, after preservation in spirit, measured 115 mm. in length by 6 mm. in greatest breadth; I could not get it to crawl about actively so as to measure it when crawling. A smaller specimen, however, in which also a portion of the posterior extremity was broken off, measured about 163 mm. in length by 5 mm. in breadth when crawling. The peripharyngeal aperture (in spirit) is in about the middle of the ventral surface and the genital aperture about

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* "Notes on Australian Land Planarians, with Descriptions of some New Species, Part I." Proceedings of the Linnean Society of New South Wales, Vol. II (Series 2), 1887, p. 364.

half-way between the peripharyngeal and the posterior extremity. The eyes are not very numerous, in two patches one on each side of the anterior end of the body and continued in close-set single series all round the anterior margin. The predominant tint of the dorsal surface varies from green or violet to rich reddish-brown or brownish-red. Running down the mid-dorsal line is a very narrow stripe of bright yellow. On each side of this is a slightly broader stripe of dark brown, whose outer edge is ill-defined. Then a still slightly broader stripe of bright yellow with a few very minute flecks of brown. Then a very broad, dark band of the predominant tint, most commonly dark greenish-brown or grey, almost black, gradually fading outwards into a narrow band of pale greyish or greenish-blue. Then a narrow stripe of a very dark brownish colour only slightly wider than the narrow blue band, and, lastly, another narrow blue band but wider than the first and extending to the margin of the ventral surface. The anterior extremity is pinkish. In the mid-ventral line there is a rather narrow, almost white band gradually merging on each side into a pale purplish-grey band which, in turn, gradually merges into the pale greenish-blue band at the margin of the dorsal surface.

All things considered, I have little hesitation in identifying this species with Messrs. Fletcher and Hamilton's *G. variegata*, especially as the latter appears to vary somewhat in tint. As this very handsome species has not before been figured of the natural colours, I have thought it desirable to do so now.

Localities.—Gympie (Mary River); Burnett River; Cooran.

3. *Geoplana minor*, n. sp.

Body at rest much flattened; when crawling very long and narrow, nearly cylindrical, tapering very gradually in front and more suddenly behind, and measuring only about 18 mm. in length by 1 mm. in greatest breadth. The peripharyngeal aperture (in spirit) is situate in about the middle of the ventral surface and the genital aperture about half way between it and the posterior end. The eyes are not very numerous, arranged in a single row at the sides of the head-end and all round the anterior margin, and also very sparingly down the sides of the body to the posterior

extremity. The colour of the living animal is milk-white all over, sometimes with a yellowish tinge.

This very small Planarian was met with in abundance both at Cooran and on the Burnett River. I at first thought it might be the young of *Geoplana alba* but microscopical examination showed it to be sexually mature and, moreover, no large specimens were met with. It may possibly be a dwarf variety of *G. alba*, but careful anatomical investigation will be required to decide this point. Meanwhile it appears advisable to give it a distinct name.

Localities.—Burnett River; Cooran.

4. *Geoplana regina*, n. sp.

(Plate XI, Figs. 1, 1*a*, 1*b*.)

The body is remarkably broad and, when at rest, very much flattened on both surfaces. When the animal is crawling, however, the dorsal surface is strongly arched and the body tapers very gradually in front and behind. When crawling the animal measures about 66 mm. in length and 5·5 mm. in greatest breadth. In spirit the body is flat or even concave on the ventral surface, but pretty strongly arched on the dorsal, and the posterior half of the body is, on an average, a good deal broader than the anterior half. The peripharyngeal aperture is decidedly behind the middle of the ventral surface but in front of the junction of the middle and posterior thirds. The genital aperture is about half way between the peripharyngeal aperture and the posterior extremity. The eyes are arranged as usual in the genus.

The ground colour of the dorsal surface is rich gamboge-yellow, almost orange, interrupted by eleven longitudinal stripes of varying shades of brown, as follows (Fig. 1*a*) :—In the mid-dorsal line there is a very broad stripe of very dark, rich brown; on either side of this median stripe is a band of ground colour of only about half the width; then comes a still narrower and somewhat faint stripe of light brown; then another band of ground colour similar to the last; then another brown stripe a good deal darker than the last; then another band of ground colour as before; then another still darker stripe of brown; then another band of ground colour as before; then another brown stripe, this time light-coloured; then another band of ground colour as

before and then, on the extreme lateral margin, a moderately dark brown stripe. Hence we have, on each side of the broad median stripe, five bands of ground colour alternating with five narrow brown stripes of varying intensity, the middle one of the five being the darkest and broadest. The inner margins of the narrow brown stripes are less well defined than the outer and tend to shade off into the ground colour. The horse-shoe-shaped anterior extremity is dark brown. The ventral surface has also a characteristic pattern (Fig. 1*b*). The ground colour is white. In the middle line there is a moderately broad band of ground colour with no markings, slightly broader around the external apertures (which lie in it) than elsewhere. On either side of this median band, and extending almost to the margin of the ventral surface, is a very broad band of ground colour spotted all over with small flecks of light brown. The brown flecks are pretty evenly distributed except at the outer margin of the spotted band, where they are closer and run together into an irregular, very narrow stripe. Outside this stripe a narrow band of white, with no flecks, extends to the outer margin of the outermost of the narrow brown dorsal stripes.

Only two specimens of this very handsome species were obtained.

Locality.—Gympie (Mary River).

5. *Rhynchodemus obscurus*, Fletcher and Hamilton.*

I have some little hesitation in making this identification. The characters of the species are not at all striking and there were only a few specimens in the collection. When the animal is crawling the body is very long and narrow, strongly convex on the dorsal surface and flattened on the ventral. It scarcely tapers at all to the anterior extremity but tapers gradually posteriorly. One specimen measured 60 mm. in length by 1·7 mm. in greatest breadth when crawling. In spirit the peripharyngeal aperture is situated in about the middle of the ventral surface and the genital aperture about half way between it and the posterior end. The eyes are arranged as usual in the genus, viz., a single pair placed a short way behind the anterior extremity. The

* "Notes on Australian Land Planarians, &c." Proc. Linn. Soc., N.S.W., Vol. II (Series 2), p. 372.

dorsal surface in life was of a uniformly black colour, the anterior extremity rather lighter and the ventral surface brownish-grey.

Localities.—Gympie (Mary River) ; Cooran.

6. *Bipalium kewense,* Moseley.*

Two specimens of this remarkable Planarian were obtained. When alive the body was very long and narrow, especially when crawling. The head was, as usual, crescentic or "cheese-cutter-shaped." After preservation in spirit the peripharyngeal aperture was situate in about the middle of the ventral surface; the genital aperture I could not distinguish. The ground colour on the dorsal surface of the living animal was olive-brown, interrupted by five dark stripes arranged as follows:—In the middle line a narrow black stripe; on each side of this two dark olive-grey stripes, the outer one being narrower and less well-defined than the inner. The outer and inner paired stripes of each side unite together anteriorly just behind the head. All the stripes stop at the neck and the cheese-cutter-shaped head has a dark purplish-grey colour in front of a lighter transverse band which marks the junction of head and body. The ventral surface was pale grey in the middle line with a darker grey stripe on each side and then, outside this, a pale olive-brown band extending to the outer dark dorsal stripe.

The specimens agreed closely with the figures given by Bell† except for the presence of the outer dark stripes on the dorsal surface, which are not shown in Bell's figures but are described by Moseley in his original paper. I take the present opportunity of stating that I do not at all agree with Professor Bell's remarks as to the uselessness of the head as a generic character. The head, of course, like all other parts of the body of a Planarian, is capable of great changes of shape in the living animal. No one would deny this for a moment, but, at the same time, the head is always there and always has a certain *normal* shape to which it constantly returns and which is eminently characteristic. Nothing could be more striking than the difference between *Geoplana*

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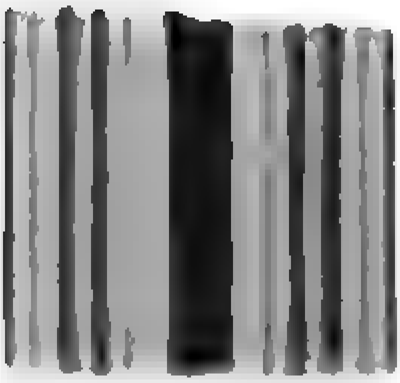
* "Description of a New Species of Land-Planarian from the Hothouses at Kew Gardens." Annals and Magazine of Natural History, S. 5, Vol. I, p. 237.

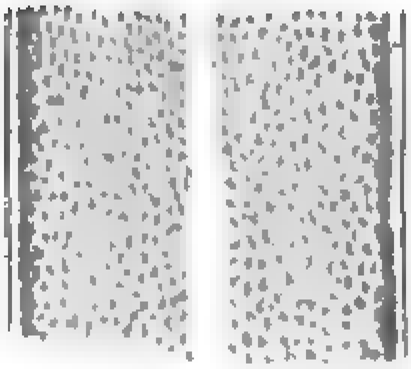
† "Note on *Bipalium kewense*, and the generic characters of Land-Planarians." Proceedings of the Zoological Society of London, 1886, p. 166, Plate XVIII.

1

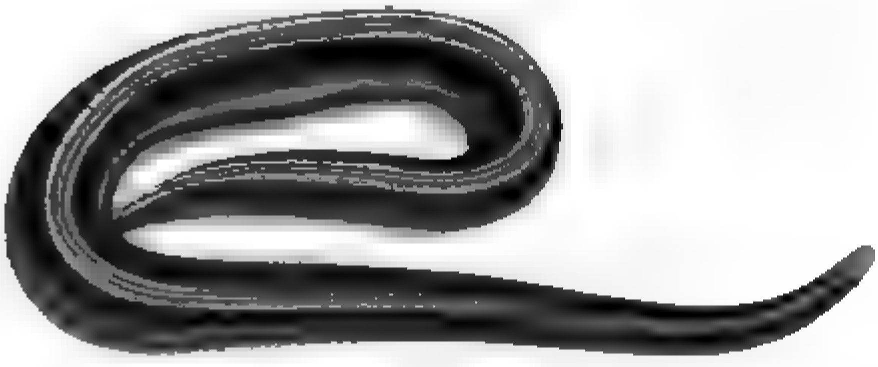
1a



1b



2



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or *Rhynchodemus* and *Bipalium* with regard to the form of the anterior extremity, and, having carefully examined specimens of these three genera both alive and in spirits, I have no hesitation in saying that the remarkable development of the head in *Bipalium* is a most marked and important character and of great value for purposes of classification.

Professor Spencer thinks that *Bipalium kewense* was probably introduced by the agency of man to the locality where he found it, as has now been the case in so many places. Possibly the original home of this remarkable worm will ever remain a mystery. Within recent years it has made its appearance in large numbers in the neighbourhood of Sydney, as described in a very interesting paper* by Mr. Fletcher, who has also recorded the species from Victoria and Samoa. I am not aware that it has hitherto been recorded from Queensland.

Locality.—Gympie (Mary River).

DESCRIPTION OF PLATE XI.

FIG. 1.—*Geoplana regina*, n. sp. The animal lying at rest with the head in the centre of the coil × 2.

FIG. 1*a*.—*Geoplana regina*, n. sp. Portion of the dorsal surface, showing the colour and arrangement of the markings × 4.

FIG. 1*b*.—*Geoplana regina*, n. sp. Portion of the ventral surface, showing the colour and arrangement of the markings × 4.

FIG. 2.—*Geoplana variegata*, Fletcher and Hamilton. Specimen from South Queensland × 3.

(All the figures are drawn from living animals.)

* "Remarks on an introduced Species of Land Planarian, apparently *Bipalium kewense*, Moseley." Proceedings of the Linnean Society of New South Wales, Vol. II (Series 2), p. 244.

ART. XVII.—*Preliminary Description of Victorian Earth-worms. Part I.—The Genera Cryptodrilus and Megascolides.*

By W. BALDWIN SPENCER, M.A.

Professor of Biology in the University of Melbourne.

(With Plates XIV, XV, XVI, XVII, XVIII, XIX.)

[Read December 10, 1891.]

For the past four years I have been gradually collecting earth-worms as opportunities offered and the present paper merely contains brief descriptions of forms of the genera Cryptodrilus and Megascolides which have been met with in Victoria.

Mr. J. J. Fletcher, to whom we owe almost entirely our knowledge of Australian earth-worms described up to the present time, has already published brief accounts of, principally, New South Wales forms. I am much indebted to him both for specimens of those which he has described and for valuable advice and information, and it may perhaps be as well to state here that we are at present engaged together upon a somewhat extensive monograph dealing with Australian earth-worms. The completion of this joint work will of necessity occupy considerable time, though we hope to publish very shortly the first part, which will deal with the systematic arrangement of the forms.

Our collection is very extensive, and necessitates a revision of the genera, but meanwhile we have thought it advisable to adhere to existing genera and to give names which will serve at present for identification.

In the preliminary notices of Victorian forms, I have purposely refrained from dealing with any but macroscopic

characters, and have not even entered into details with regard to these, other than such as will serve for identification.

A full description, especially as regards the nephridia, genital organs and setæ, which will serve as the basis of a revised classification, is not attempted to be given in this preliminary account. This notice, therefore, contains merely brief descriptions of eleven new species of Cryptodrilus, and of ten new species of Megascolides. In addition to these, two more species have been previously described, viz., *M. australis* (McCoy), and *M. tuberculatus* (Fletcher).

It will be seen that the latter genus is much more strongly represented proportionately in Victoria than in New South Wales. It is one of those series of forms which are more or less characteristic of the south eastern corner of Australia, spreading thence to a slight extent up the eastern coastal district, but dying out to the north. Doubtless it will be found to be strongly developed in Tasmania, since in their faunas, Victoria, south of the Main Dividing Range, and Tasmania are closely allied.

The annual camping out expeditions of the Victorian Field Naturalists' Club have enabled me to collect in very inaccessible parts of the colony, especially in Croajingolong and the mountain ranges around the source of the Yarra, and I am much indebted for valuable assistance, both on these and other occasions, to Messrs. C. French, C. Frost, A. H. S. Lucas, T. Steel, J. Hulme, D. le Souef, W. Mann, J. Shephard, Hugh Copeland, C. Brittlebank, H. R. Hogg, the Rev. W. Fielder, and Dr. Dendy.

As stated above, the present classification can only be regarded as a temporary one with regard to the two genera now dealt with, but the collection which Mr. Fletcher and myself now possess will, we trust, enable us to satisfactorily deal with this question in a short time.

In the descriptions, I have used the terms employed by Dr. Benham in his valuable paper, "An Attempt to Classify Earth-worms"* and may here express the indebtedness of workers in this group of forms to the recent researches of Dr. Benham and Mr. Beddard.†

* Q.J.M.S., Vol. XXXI, Part 2, p. 201.

† Published principally during the past few years in the *Quarterly Journal of Microscopical Science*.

(*a*) CRYPTODRILUS (Fletcher).

(1) *C. gippslandicus*, sp. n. (Figs. 1, 2, 3, 63). Spirit specimens 5 inches long, one-third inch broad.

Prostomium completely dovetailed into the peristomium.

Peristomium, with grooves, giving it a ribbed appearance.

Clitellum fairly well developed ; red-brown colour dorsally and laterally (in spirit), extending over segments 14–16, together with the posterior part of 13, and the anterior of 17.

Setæ, regularly arranged in couples along the anterior half of the body. Then the two outer rows become irregular, and along the posterior third of the body all the rows are very irregular, giving to this part of the body, at first glance, much the appearance of a perichæte.

Male pores on papillæ on segment 18, at the level of the interval of the two inner setæ of each side.

Oviduct pores on segment 14 ventral of, and slightly anterior to, the innermost setæ on each side.

Spermathecal pores five in number ; intersegmental ; at the level of the first seta. The first between segments 4 and 5.

Dorsal pores present. The first between segments 3 and 4.

Nephridiopores difficult to distinguish ; at the level of, and in front of the third seta of each side, commencing on the third segment.

Alimentary canal. Gizzard in segment 5. Vascular swellings on the œsophagus in segments 8–13.

Calciferous glands in segments 14 and 15. Large intestine commencing in segment 17.

Blood vascular system. Dorsal blood-vessel *double* from the sixth segment to within about twenty of the posterior end. That is, there is a very distinct double loop in each segment, the two halves uniting where they pass through the septa. Hearts in segments 6–12, the two first small. A supra-intestinal vessel in the segments containing the hearts.

Excretory system. Meganephric, with a coiled portion ventrally on each side, from which a duct runs upwards to the third seta.

Reproductive system. Testes, two pairs attached to the anterior walls of segments 10 and 11. Ciliated rosettes in the same segments.

Prostates, coiled, tubular, and in segments 18 and 19.

Sperm sacs finger-shaped, attached to the posterior walls of segments 9 and 10.

Ovaries attached to anterior wall of segment 13; oviducts open into the same segment.

Spermathecæ in segments 5–9. Each consists of a long sac, with a simple diverticulum about one-quarter the length of the sac.

Habitat. Croajingolong (East Gippsland). Collected during an expedition of the Field Naturalists' Club of Victoria.

(2) *C. intermedius*, sp. n. (Figs. 4, 5, 6, 64). Spirit specimens 7 inches long, one-quarter inch broad.

Prostomium very slightly dovetailed into the peristomium.

Peristomium, with grooves, giving it a ribbed appearance.

Clitellum well developed, extending over segments 14–17 and may include dorsally when fully developed the anterior part of 18.

The ventral parts of segments 17, 18 and 19, marked by transverse swollen bands.

Setæ in couples, regularly arranged, except at the very posterior end of the body, where the two outer rows are irregular. The outer couple placed laterally and slightly further apart from one another than the inner.

Male pore, on segment 18, at the level of the first seta of each side, on a slight papilla.

Oviduct pores on segment 14 slight ventral of, and anterior to, the first setæ.

Spermathecal pores two in number; intersegmental; at the level of the first setæ, between segments 7 and 8, 8 and 9.

Dorsal pores present. The first between segments 5 and 6.

Nephridiopores at the level of, and anterior to, the third seta on each side.

Alimentary canal. Gizzard in segment 5. Vascular swellings on the œsophagus in segments 10–17. Those in segments 15–17 large. No true calciferous glands. Large intestine commencing in segment 19.

Blood vascular system. Single dorsal vessel. Hearts in segments 6–13. Lateral vessel in segments 5–8, sending branches on to the walls of the pharynx. A supra-intestinal vessel in the segments containing the hearts.

Excretory system. Meganephric. One pair of nephridia in each segment.

Reproductive system. Testes, one pair in segment 11. One pair of ciliated rosettes in the same segment. Prostates,

coiled, tubular, and in segment 18. Sperm sacs, large, grape-like, attached to the anterior wall in segment 12, with smaller ones on the anterior wall in segment 14.

Ovaries attached to the anterior wall of segment 13; oviducts open into the same segment.

Spermathecæ in segments 8 and 9. Each consists of a long sac with a small rosette-like diverticulum close to the base.

Habitat. S. Warragul, Gippsland. Collected by Mr. W. Mann.

(3) *C. tanjilensis*, sp. n. (Figs. 7, 8, 9, 65). Spirit specimens $5\frac{1}{2}$ inches long, $\frac{1}{2}$ inch broad.

Prostomium completely dovetailed into the peristomium, with a dorsal longitudinal groove continuous along the body. Ventrally, a median groove only at the very posterior end.

Clitellum strongly developed, complete, occupying segments 14–16, together with the posterior part of 13 and anterior of 17.

Setæ regularly arranged along the whole length of the body. The outer couple wider apart than the inner, and the fourth row placed dorso-laterally.

Male pores on papillæ on segment 18, at the level of the interval between the two innermost setæ of each side.

Oviduct pores on segment 14 ventral of, and slightly anterior to, the innermost setæ of each side.

Spermathecal pores five in number; intersegmental; at the level of the first setæ; the first between segments 4 and 5.

Accessory copulatory structures present at the level of the first setæ between segments 18 and 19, and 19 and 20.

Nephridiopores at the level of, and in front of the third seta of each side. Very prominent on the last few segments

Alimentary canal. Gizzard in segment 5. Vascular swellings on the œsophagus in segments 7–15; large in segment 15. No true calciferous glands. Large intestine commencing in segment 18.

Blood vascular system. Single dorsal vessel. Hearts in segments 7–12. Supra-intestinal vessel in segments containing the hearts and extending back into segment 13.

Excretory system. Meganephric, with a coiled portion ventrally, and a long sac-like part dorsally, which is larger in and before the clitellum than in the segments posterior to this.

Reproductive system. Testes, two pairs attached to the anterior walls of segments 10 and 11. Ciliated rosettes in the same segments, which are full in mature specimens of sperm.

Prostates, coiled, tubular, and in segment 18.

Sperm sacs attached to the anterior wall of segment 12, saccular in form.

Ovaries attached to the anterior wall of segment 13; oviducts open into the same segment.

Spermathecæ in segments 5–9. Each consists of a long sac, with a simple diverticulum, about one-quarter the length of the sac.

Habitat. Tanjil Track, near the source of the Yarra River. Collected during an expedition of the Field Naturalists' Club of Victoria to the Yarra Falls, near the source of the River Yarra.

(4) *C. frenchi*, sp. n. (Figs. 10, 11, 12, 66). Spirit specimens 3 inches long, $\frac{1}{8}$ inch broad.

Prostomium dovetailed into the peristomium to the extent of $\frac{1}{2}$ or $\frac{3}{4}$.

Clitellum occupying segments 14–16; not very distinctly marked ventrally.

Setæ in four couples, regularly arranged, except at the posterior end of the body. Prominent. The inner couple nearer together than the outer, the fourth row being dorso-lateral. For the posterior one-sixth of the body the two outer rows are irregular and on the last few segments all are except the innermost on each side.

Male pores on papillæ on segment 18, at the level of the interval between the inner couple of setæ on each side.

Oviduct pores on segment 14, close to the anterior margin and slightly ventral of the inner setæ.

Spermathecal pores, five in number, just on the very anterior boundaries of segments 5–9, at the level of the interval between the inner couple of setæ.

Accessory copulatory structures as follows:—Small oval patches anteriorly on segments 10 and 11 at the level of the spermathecal ducts. Patches on each side of the body at the level of the interval between the inner couple of setæ from segments 16–21. Each patch is composed of a small part of two contiguous segments and the pairs are united across the mid-ventral line by glandular ridges.

Dorsal pores present. The first between segments 4 and 5.

Nephridiopores at the level of the third seta in each segment, commencing on the third.

Alimentary canal. Gizzard small and in segment 6. Vascular swellings on the œsophagus in segments 9–15, but no true calciferous glands.

Blood vascular system. Dorsal blood-vessel single. Hearts in segments 7–12, the first two small. Supra-intestinal vessel in segments 8–12, and continued back into the anterior part of segment 13.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs attached to the anterior walls of segments 10 and 11. Ciliated rosettes in the same segments. Sperm sacs attached to the anterior wall of segment 12 and the posterior of segment 9, the latter finger-shaped.

Prostates long, tubular, and coiled, occupying segments 18–21.

Ovaries attached to the anterior wall of segment 13; oviducts open into the same segment.

Spermathecæ in segments 5–9. Each with a long sac and short diverticulum about one-third the length of the main sac.

Habitat. Croajingolong (E. Gippsland). Collected during an expedition of the Field Naturalists' Club of Victoria.

(5) *C. dubius*, sp. n. (Figs. 13, 14, 15, 67). Spirit specimens 3½ inches long, less than one-quarter inch broad.

Prostomium completely dovetailed into the peristomium, which is ribbed.

Clitellum distinct and complete, occupying segments 14–17.

Setæ in four couples, regularly arranged; interval between the inner and outer couples, and between the two rows of the outer couple double that between the two rows of the inner couple. The fourth row, dorsally placed.

Male pores on distinct papillæ in segment 18, slightly ventral of the level of the second row of setæ.

Oviduct pores on segment 14, slightly anterior to, and ventral of, the innermost setæ.

Spermathecal pores, two in number, on the very anterior margin of segments 8 and 9, at the level of the innermost setæ.

Accessory copulatory structures. Two small glandular patches on segment 17, at the level of the intervals between the inner rows of setæ, and a median ventral patch on the anterior margin of segment 18.

Dorsal pores present, the first between segments 5 and 6.

Nephridiopores conspicuous, commencing on the second segment, and placed on each side anteriorly to, and at the level of, setæ 1, 3 and 4.

Alimentary canal. Gizzard in segment 5. Vascular swellings on the œsophagus in segments 12, 13 and 14. True calciferous glands well developed in segments 15 and 16. Large intestine commencing in segment 18.

Excretory system. Meganephric (?) with three coiled tubes on each side in each segment, corresponding to the nephridiopores. (The nephridia of this form are very interesting and probably indicate an aggregation of plectonephric tubules into three groups).

Reproductive system. Testes doubtful. One pair present, but small, in segment 10, attached to the anterior wall; probably a pair in segment 11. Ciliated rosettes distinct in segments 10 and 11.

Prostates double. A smaller anterior coiled tubular mass in segments 17 and 18; a posterior larger mass in segments 18-21. Separate duct from each, the two uniting together and having a single opening in segment 18.

Sperm sacs in segments 11 and 12. Each has the form of a saccular dilatation attached to the anterior wall of the segment. The anterior one probably encloses a testis.

Ovaries in segment 13. Oviducts opening into the same segment.

Spermathecæ, two pairs. Each consists of a long sac, with two short club-shaped diverticula arising from the duct.

Habitat. Victoria. This probably comes from Croajingolong but the distinct locality other than Victoria is not noted.

It is evidently closely allied to *C. fastigatus*, Fl., but is distinct from this (1) in the possession of well developed calciferous glands in segments 15 and 16, and (2) in the sperm sacs not being racemose. The curious double nature of the prostates, and the identical arrangement of the nephridia shows the two forms to be closely allied, but at present, pending the publication of our full report, they are placed as distinct species in the genus Cryptodrilus.

(6) *C. macedonensis*, sp. n. (Figs. 16, 17, 18, 68). Spirit specimen 3 inches long, one-eighth inch broad.

Prostomium not dovetailed into the peristomium, which is ribbed.

Clitellum distinct, complete and brown coloured in spirit specimens, the rest of the body being bleached.

Setæ, four couples, regular along the whole length. The intervals between the two couples of each side, and between the two rows of the outer couple very nearly equal and each more than twice as great as that between the rows of the inner couple. The fourth seta nearly dorsally placed.

Male pores on papillæ on segment 18, at the level of the interval between the two inner rows of setæ.

Oviduct pores on segment 14 slightly anterior to and ventral of, the innermost setæ.

Spermathecal pores, four in number, on the anterior margins of segments 6–9, slightly ventral to the level of the innermost setæ, each on a distinct little papilla.

Accessory copulatory structures very well marked. A large tumid patch occupying the median ventral part of segment 11, the anterior edge of segment 12 and the posterior of segment 11; or this may be divided into two parts, one occupying the anterior ventral part of segment 11 and the posterior part of segment 10: the other, the corresponding parts of segments 11 and 12.

Behind the clitellum, tumid ridges are present, the first of which occupies the posterior ventral part of segment 17, and anterior of segment 18, and others occupying corresponding positions on segments 18 and 19, 19 and 20, 20 and 21, 21 and 22. Each has a median linnear groove, corresponding in position to the intersegmental groove.

Dorsal pores present, the first between segments 4 and 5. Nephridial pores not easily seen, but are placed at the level of the third seta on each side.

Alimentary canal. Gizzard in segment 5, but not occupying the whole of the segment. Vascular swellings on the œsophagus, but no true calciferous glands. Large intestine commencing in segment 18.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs in segments 10 and 11. Ciliated rosettes in the same segments.

Prostates in segment 18, coiled, tubular, with distinct coiled duct.

Sperm sacs small, and slightly racemose, in segment 12.

Ovaries in segment 13, and oviducts opening into the same segment.

Spermathecæ, four pairs in segments 6–9, each one markedly large in comparison to the size of the body and consisting of a distinct stalk, with swollen sac, and at the base of the stalk, a small diverticulum.

Habitat. Mt. Macedon, Victoria. Collected by Mr. H. R. Hogg and myself.

(7) *C. victoriæ*, sp. n. (Figs. 19, 20, 21, 69). Spirit specimen 4 inches long, three-eighths inch broad.

The prostomium completely dovetailed into the peristomium. There is a very distinct median, dorsal and ventral groove running the whole length of the body (in spirit specimen).

Clitellum fairly distinct and complete, occupying segments 14–16.

Setæ prominent, and in four couples regularly arranged, except at the posterior end of the body, where the last few segments are distinct from and smaller than the others. Male pores on papillæ on segment 18, each slightly dorsal to the level of the innermost setæ.

Oviduct pores on segment 14, slightly anterior to, and ventral of, the position of the innermost setæ.

Spermathecal pores, five in number; intersegmental; the first between segments 4 and 5.

Accessory copulatory structures feebly developed. A median, ventral, glandular patch on the anterior halves of segments 9 and 10, together with faintly marked intersegmental patches immediately in front of and behind the male openings.

Dorsal pores present, the first probably between segments 2 and 3, one certainly present between segments 3 and 4.

Nephridiopores at the level of the third setæ, commencing at the second segment.

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but vascular swellings present in segments 9–15. Large intestine commencing in segment 17.

Circulatory system. Single dorsal vessel with the last pair of hearts in segment 12.

Excretory system. Meganephric, with a coiled tube in each segment ventrally, from which a long duct leads up to the level of the third setæ.

Reproductive system. Two pairs testes, in segments 10 and 11, with funnels opening into the same segments which are filled with sperm.

Prostates, long coiled tubes, extending through segments 18–26.

Sperm sacs. Saccular structures, attached to the anterior wall of segment 12 and the posterior of segment 9.

Ovaries, one pair in segment 13, with oviducts opening into the same.

Spermathecæ. Five pairs in segments 5–9. Each consists of a large sac with a tubular diverticulum arising from the stalk, and about one-third the length of the sac.

Habitat. Collected at Warburton, Yarra Valley, by Dr. Dendy.

(*Var. a*) Length of spirit specimen 2¾ inches, one-quarter inch broad.

The general anatomy closely similar to the typical form, from which it differs (1) in the irregularity of the setæ extending slightly further along the body; (2) in the presence of a curious elongate white smooth surface, extending ventrally from segment 17 to segment 23; (3) in the openings of the spermathecæ being slightly dorsal of the level of the innermost setæ, and (4) in the diverticulum of the spermathecæ being relatively longer than in the typical form.

Habitat. Thompson Valley. Tanjil Track.

(*Var. b*) Length of spirit specimen 3 inches, one-quarter inch broad. The body more robust and lighter colour than in *var. a*.

The irregularity of the setæ extends further forwards along the body than in *var. a*. A white smooth surface of skin extends ventrally in the region of the male pores, as in *var. a*, and there is present in addition a similar surface ventrally on segments 4–9.

No testes can be seen, though the rosettes are well developed in segments 10 and 11. Prostates long and coiled, exactly as in the typical form. The spermathecæ have very small knob-like diverticula.

Habitat. Victoria (exact locality not known).

(8) *Cryptodrilus willsiensis*, sp. n. (Figs. 22, 23, 24, 70).
Spirit specimen 7½ inches long, half inch broad.

Prostomium very slightly dovetailed into the peristomium, which is ribbed. Median ventral furrow on prostomium.

Clitellum not strongly glandular, but clearly indicated by its reddish colour in spirit, extending over segments 14–17.

Setæ prominent. Four couples of which, the outer on each side, is dorso-lateral in position. As far back as the clitellum they are regularly arranged, the rows of the outer couple being nearly three times as far away from one another as those of the inner couple. The fourth row is slightly irregular in the clitellar region but is fairly regular for about two-thirds the length of the body, then it becomes exceedingly irregular. The third row is noticeably regular till quite the posterior end of the body, when it becomes slightly irregular. The second and first rows are regular till within 20 segments of the posterior extremity, when they become irregular. At the posterior end there may be 5 setæ present on each side of the body.

Male pores placed on papillæ, in segment 18, at a level corresponding to the interval between the two rows of the inner couple of setæ.

Oviduct pores on segment 14.

Spermathecal pores intersegmental in position, between segments 4 and 5, 5 and 6, 6 and 7, 7 and 8, 8 and 9.

Accessory copulatory structures scarcely indicated.

Nephridiopores on the anterior margin of each segment at the level of the third seta.

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but vascular swellings. Large intestine commencing in segment 18.

Circulatory system. Dorsal vessel double in each segment, as far forward as the fifth segment. In the latter, the two halves unite on the top of the gizzard and run forward as a single vessel. Hearts in segments 5–12.

Excretory system. Meganephric.

Reproductive system. Testes in segments 10 and 11, into which also the rosettes open.

Prostates coiled, tubular, in segment 18.

Sperm sacs. Saccular in nature and attached to the anterior wall of segment 12, and the posterior of segment 9.

Ovaries in segment 13, into which the oviducts open.

Spermathecæ, 5 pairs in segments 5–9. Each consists of a sac, with a double diverticulum.

Habitat. Mt. Wills. Collected by Mr. T. Lidgey.

(9) *Cryptodrilus narrensis*, sp. n. (Figs. 25, 26, 27, 71).

Length in spirit 1¾ inches long, one-eighth inch broad.

Prostomium incompletely dovetailed into the peristomium (about one-half).

Clitellum well marked, occupying segments 14–17, whilst the posterior part of 13, and the anterior of 18, may be modified dorsally. The posterior half of segment 17 ventrally, may be sharply marked off, and not glandular in appearance.

Setæ regularly arranged in four rows. At the anterior end, the outer couple is lateral in position, the rows of setæ being slightly further apart than those of the inner couple. Posteriorly, the rows gradually separate from one another, until the fourth becomes dorsal in position.

Male pores on papillæ in segment 18, at the level of the interval between the rows of the inner couples of setæ.

Oviduct pores on segment 14, on a slight glandular space in front of, and ventral of the level of the innermost setæ.

Spermathecal pores intersegmental in position, between segments 7 and 8, and 8 and 9. Slightly dorsal to the level of the innermost setæ.

Accessory copulatory structures. Two circular patches, one immediately in front of and one immediately behind the male openings; each small and in the mid-ventral space, between the innermost rows of setæ of each side.

Nephridiopores at the level of the third setæ (?)

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but vascular swellings in segments 15 and 16. Large intestine commences in segment 20.

Circulatory system. Single dorsal blood-vessel. Last heart in segment 12.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs in segments 10 and 11, into which the rosettes also open.

Prostates, coiled, tubular, and in segments 18 and 19.

Sperm sacs, grape-like, attached to the anterior walls of segments 14 and 12, and the posterior wall of segment 9.

Ovaries in segment 13, into which the oviducts open.

Spermathecæ, two pairs in segments 8 and 9. Each consists of a long saccular part, with a diverticulum about one-third its length.

Habitat. Narre Warren, Gippsland. Collected by Mr. C. French and myself. Very abundant under logs in wet weather.

(10) *Cryptodrilus lucasi*, sp. n. (Figs. 28, 29, 30, 72). Length in spirit $4\frac{1}{2}$ inches, slightly more than one-eighth inch broad.

Prostomium only slightly dovetailed into peristomium (about $\frac{1}{3}$).

Clitellum well marked, occupying segments 14–17, together with the anterior part of segment 18, and posterior of segment 13. The middle of segment 17 is not included ventrally, but together with the same part of segments 18 and 19, is white and swollen in spirit specimens.

Setæ in four couples, all of which, for the greater part of the length of the body, are placed close to the ventral surface. For the posterior third of the body, the two outer rows are irregular.

Male pores on small papillæ on segment 18, slightly dorsal of the level of the innermost row.

Oviduct pores on segment 14, slightly anterior to, and ventral of the level of the innermost setæ.

Spermathecal pores, two pairs, intersegmental, between segments 7 and 8, 8 and 9, and at the level of the innermost setæ.

Dorsal pores present, the first between segments 4 and 5.

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but the œsophagus is markedly swollen and vascular in segments 9–13. Large intestine commences in segment 15.

Circulatory system. Single dorsal vessel, hearts in segments 6–12, those in segments 9–12 large.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs in segments 10 and 11, rosettes opening in the same segments.

Prostates, tubular and coiled, in segments 16–18.

Sperm sacs, grape-like, in the anterior wall of segment 12, and posterior of segment 9.

Ovaries in segment 13, the oviducts opening into the same segment. An extra pair of ovaries may be present in segment 14.

Spermathecæ. Two pairs in segments 8 and 9. Each consists of a large sac with a diverticulum, having the form of a rosette.

Habitat. Tallarook, Goulburn River. Collected by Mr. A. H. S. Lucas, M.A.

(11) *Cryptodrilus minor*, sp. n. (Figs. 31, 32, 33, 73). Length in spirit 2–5 inches. Very narrow.

Setæ, for the greater part of the length of the body, arranged in four couples, of which the two rows in each are close together, the outer couple being dorso-lateral in position. The ventral row is straight throughout, the second row becomes irregular at the very posterior end, and about $\frac{9}{10}$ of the way down the body, the two upper rows suddenly become very irregular.

Prostomium very slightly dovetailed into the peristomium.

Clitellum well developed, occupying segments 14–17 very slightly, the anterior part of 18 dorsally.

Male pores on segment 18, at the level of the interval between the two innermost setæ of each side.

Oviduct pores in a linnear depression on segment 14, anterior to, and ventral of, the innermost setæ.

Accessory copulatory structures. Two depressed elliptical patches, one on segment 17 ventrally, and another on segment 19.

Dorsal pores not visible in front of the clitellum.

Nephridiopores at the level of the third setæ (?)

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but large swollen portions of the œsophagus in segments 13–18. Large intestine commencing in segment 20.

Circulatory system. Single dorsal vessel, with the last heart in segment 12.

Excretory system. Meganephric.

Reproductive system. Testes, one pair in segment 11, into which open the rosettes.

Prostates, small, tubular, and coiled, in segment 18.

Sperm sacs, grape-like, in segment 12 on the anterior wall.

Ovaries in segment 13, into which open the oviducts.

Spermathecæ, two pairs in segments 8 and 9, each one consisting of a large sac with a triple diverticulum.

Habitat. South Warragul, Gippsland. Collected by Mr. W. Mann.

(*b*) MEGASCOLIDES, McCoy (= Notoscolex, Fletcher).

(1) *M. cameroni*, sp. n. (Figs. 34, 35, 36, 74). Length of spirit specimen 8½ inches, half inch broad.

Prostomium incompletely dovetailed into the peristomium (about ½). Peristomium ribbed.

Clitellum well marked, but incomplete ventrally, especially at the anterior end.

Setæ somewhat difficult to see. In four couples, the outer couple being placed laterally, and having its two rows slightly farther apart than those of the inner couple. The setæ become irregular in the upper two rows in the clitellar region, the innermost row of each side being regular along the whole length.

Male pores on two papillæ on segment 18, at the level of the innermost setæ.

Oviduct pores on segment 14.

Spermathecal pores, five in number; intersegmental; the first between segments 4 and 5.

Dorsal pores present, the first between segments 3 and 4.

Alimentary canal. Gizzard occupying half of segments 5 and 6. No true calciferous glands, but vascular swellings present in segments 8–14. Large intestine commences in segment 19.

Circulatory system. Dorsal vessel double in each segment as far forward as the fifth segment. The last heart is in segment 13, and a lateral vessel is present on each side in segments 5–11, and a supra-intestinal in segments 8–14.

Excretory system. Plectonephric. The little nephridial tufts are very minute, but for the posterior third of the body, large paired nephridia are present ventrally, with internal funnels.

Reproductive system. Testes, two pairs in segments 10 and 11, with rosettes opening into the same segments.

Prostates flattened with the surface mammillated in segment 18. Sperm sacs, a pair of grape-like structures on the anterior wall of segment 14, and of sac-like structures on the posterior wall of segment 9.

Ovaries in segment 13, into which the oviducts also open.

Spermathecæ. Five pairs in segments 5–9. Each consisting of a sac with a diverticulum about half the length of the sac. The spermathecæ are small in relation to the size of the body.

Habitat. Croajingolong. Collected during an expedition of the Field Naturalists' Club of Victoria.

(2) *Megascolides insignis*, sp. n. (Figs. 37, 38, 39, 75). Length of spirit specimen 6 inches, slightly more than one-quarter inch broad.

Prostomium feebly developed, and not at all dovetailed into the peristomium.

Clitellum distinct and light coloured in spirit specimens, extending over segments 13–18. Well and sharply marked dorsally; saddle shaped with ridges on the mid-ventral surface, though it tends to extend over the ventral surface and include the ridges.

Setæ in four couples, the outer couple being lateral in position and having its two rows twice as far apart as those of the inner couple. Posteriorly, the intervals between the rows composing each couple increases considerably.

Male pores on slight papillæ, in a depression on segment 18, at the level of the interval between the two rows of the inner couples of setæ.

Oviduct pores on segment 14, slightly ventral of, and anterior to the innermost setæ.

Spermathecal pores intersegmental, between segments 7 and 8, 8 and 9; at the level of the interval between the rows of the inner couples of setæ.

Accessory copulatory structures very strongly developed, white swollen ridges ventrally on segments 15–21, the setæ of the inner couples being placed on the ridges.

Dorsal pores present, the most anterior one being between segments 9 and 10.

Alimentary canal. Gizzard in segment 6. Vascular swellings on the œsophagus in segments 10 and 11, small white diverticula (calciferous glands ?) in segments 12, 13, 14, and large prominent calciferous glands in segments 15, 16, 17. Large intestine commences in segment 19.

Circulatory system. Dorsal vessel single; hearts in segments 7–13, those in segments 6–9 small.

Excretory system. Plectonephric, with larger paired nephridia at the posterior end of the body, with internal openings.

Reproductive system. Testes, a single pair in segment 11, with rosettes opening into the same. Prostates somewhat small and flattened. Sperm sacs grape-like on the anterior wall of segment 12. A small pair on the anterior wall of segment 14.

Ovaries in segment 13, with oviducts opening into the same.

Spermathecæ, 2 pairs in segments 8 and 9, each consisting of a long sac, with very short blunt diverticulum.

Habitat. Dandenong Ranges. Collected by Mr. J. Hulme.

(3) *Megascolides hulmei* sp. n. (Figs. 40, 41, 42, 76).

Of several specimens, none are perfect, some wanting the anterior, others the posterior end. These worms are remarkably long and attenuated. One specimen, which is incomplete posteriorly, measures 3 ft. 5 in. in length. Another measures the same length, but lacks the anterior end. A perfect spirit specimen will probably measure 4 feet; width $\frac{1}{3}$–$\frac{1}{4}$ inch.

Prostomium feebly developed and not at all dovetailed into the peristomium.

Clitellum remarkably developed, extending over segments 13–20, and measuring 2 inches in length. Complete and very sharply marked off at either end. The indications of the segments are completely obliterated.

Setæ, in four couples, regularly arranged; the rows of the outer couples which are lateral in position, being slightly further apart than those of the inner couple.

Male pores on segment 18 inconspicuous. Difficult to determine their position with regard to the setæ, but they are probably at the level of the innermost setæ.

Oviduct pores on segment 14.

Spermathecal pores, two pairs between segments 7 and 8, 8 and 9.

Accessory copulatory structures. A circular patch in front of the oviduct pores, partly on segments 13 and 14. Two circular patches, one on each of the segments 16 and 17. Three elliptical patches, the first half on segment 19, and half on 20; the second and third with the same relationship to segments 20 and 21, 21 and 22.

Dorsal pores present, the first between segments 8 and 9.

Alimentary canal. Gizzard in segment 5. No true calciferous glands. Large intestine commencing in segment 17.

Circulatory system. Dorsal vessel single. Hearts in segments 6–13. Supra-intestinal in segments 8–13.

Excretory system. Plectonephric. No large paired nephridia.

Reproductive system. Single pair of testes in segment 11; two pairs of rosettes, one in each of segments 10 and 11.

Prostates, flatted bodies with mammillated surface in segment 18.

Sperm sacs, grape-like, attached to the anterior wall of segment 12.

Ovaries in segment 13, into which the oviducts open.

Spermathecæ, two pairs in segments 8 and 9. Each consists of a moderately long sac, with a small blunt diverticulum.

Habitat. Dandenong Ranges. Collected by Mr. Joseph Hulme.

I have much pleasure in associating the name of Mr. Joseph Hulme with this interesting form. I am indebted to that gentleman for a valuable collection of earth-worms, including no fewer than four new species of the genus *Megascolides*, as at present described. This form ranks next in length to the giant Gippsland earth-worm.

(4) *Megascolides obscurus*, sp. n. (Figs. 43, 44, 45, 77). Length of spirit specimens 16 inches, one-half inch broad. One incomplete specimen measures 17 inches, so that probably the above is a minimum length, though the specimen is mature.

Prostomium feebly developed, and not at all dovetailed into the peristomium.

Clitellum purple in spirit specimens. Lines of the segments not obliterated, and the position of the setæ marked by minute papillæ. Extends over segments 14–18, and includes also the posterior part of segment 13, and the anterior of segment 19.

Setæ in four couples, difficult to see, except the inner two pairs. Regularly arranged (?)

Male pores on papillæ on segment 18, at the level of the interval between the rows of the inner couples.

Oviduct pores on segment 14.

Spermathecal pores, two pairs between segments 7 and 8, 8 and 9, at the level of the innermost setæ.

Accessory copulatory structures in the form of prominent ridges, the first half on segments 13 and 14, the second in segment 18, and the third and fourth half on segments 19 and 20, 20 and 21.

Dorsal pores present, the first between segments 5 and 6.

Alimentary canal. Gizzard in segment 6. No true calciferous glands. Vascular swellings on the œsophagus in segments 13, 14, and 15. Large intestine commences in segment 18.

Circulatory system. Dorsal blood-vessel single. Hearts in segments 6–13. Supra-intestinal vessel in segments 9–15.

Excretory system. Plectonephric. No large paired nephridia.

Reproductive system. Testes in segment 11. Rosettes in segments 10 and 11, those in the former small.

Prostates comparatively small, flattened, with mammillated surface, in segment 18.

Sperm sacs large in segment 12; a small pair on the anterior wall of segment 14.

Ovaries in segment 13, with oviducts opening into the same segment.

Spermathecæ, two pairs in segments 8 and 9. Each consists of a sac, with two small rounded diverticula at the base.

Habitat. Dandenong Ranges. Collected by Mr. J. Hulme.

(5) *Megascolides manni*, sp. n. (Figs. 46, 47, 48, 78). Length of spirit specimen 10 inches, one-quarter inch broad.

Prostomium not completely dovetailed into the peristomium (about half), which is ribbed.

Clitellum well marked, and slightly darker than the rest of the body in spirit specimens. Extending over segments 14–18. Complete.

Setæ in four couples, regularly arranged, the distance between the rows of the outer couple, which are laterally placed, being slightly greater than that between the inner couple.

Male pores on segment 18, slightly ventral of the level of the innermost setæ.

Oviduct pores on segment 14, on a small whitish elliptical patch on the anterior part of segment 14, the pores ventral of the level of the innermost setæ.

Spermathecal pores, two pairs between segments 7 and 8, 8 and 9, ventral of the level of the innermost setæ.

Accessory copulatory structures. Two club-shaped tumid patches, the first half on each of segments 17 and 18, the second half on each of segments 18 and 19; a depression in

each half of the patches at the level of the interval between the rows of the inner couple of setæ.

Dorsal pores present, but not visible in front of the clitellum.

Alimentary canal. Gizzard occupying half of segment 5 and the whole of segment 6. No true calciferous glands present, but vascular swellings in segments 15 and 16. Large intestine commencing in segment 18.

Circulatory system. Dorsal vessel single. Hearts in segments 6–12. Supra-intestinal vessel in segments 9–13. Strong development of blood-vessels on the walls of the gizzard.

Excretory system. Meganephric. Remarkable paired tufts of nephridiæ tubules in segments 5, 6, and 7.

Reproductive system. Testes, two pairs in segments 10 and 11, into which open the rosettes. Prostates coiled in segment 18. Sperm sacs grape-like, attached to the anterior walls of segments 11, 12, and 14.

Ovaries in segment 13, into which open the oviducts.

Spermathecæ, two pairs, one in segment 7, the other in segment 9. Each consist of a large sac and small rounded diverticulum.

Habitat. South Warragul, Gippsland. Collected by my assistant, Mr. W. Mann, to whom I am indebted for many interesting specimens of Victorian earth-worms.

Megascolides manni, var. *variabilis*.

This form, collected by Mr. Mann, in the same locality, is evidently very closely allied to the above form. It may be clearly distinguished from it, however, by the fact that the accessory copulatory structures, instead of being club-shaped, are circular in form, each one having a single median depression. The internal anatomy is closely similar to that of the typical form. In one specimen there is a pair of spermathecæ in segment 7, a single one on the left side in segment 8, and a single one on the right side in segment 9. Another specimen dissected, had two pairs as in the typical form, one in segment 7, and another in segment 9. This probably indicates that one pair present in segment 8 has in some way become suppressed.

Habitat. South Warragul, Gippsland. Collected by Mr. W. Mann.

(6) *Megascolides victoriensis* (Figs. 49, 50, 51, 79). Length of spirit specimen 3 feet, one-quarter to one-half inch broad.

Prostomium not dovetailed into the peristomium.

Clitellum well marked, and coloured purple in spirit specimens, with small white papillæ indicating the position of the setæ.

Setæ, four couples, the rows of the outer ones being four times as far apart as those of the inner ones. Setæ irregular at the posterior end of the body, where they are very difficult to see.

Male pores on papillæ on segment 18, at the level of the intervals between the setæ of the inner couple.

Oviduct pores on segment 14.

Spermathecal pores intersegmental, between segments 7 and 8, 8 and 9.

Accessory copulatory structures. White elliptical patches, the first half on segment 13, and half on segment 14. The second, third and fourth occupying the same relative positions on segments 19 and 20, 20 and 21, 21 and 22.

Dorsal pores present, the first between segments 11 and 12.

Alimentary canal. Gizzard in segment 5. No true calciferous glands. Large intestine commences in segment 17.

Circulatory system. Dorsal vessel single, the last heart in segment 13.

Excretory system. Plectonephric. No large paired nephridia.

Reproductive system. Two pairs of testes in segments 10 and 11, into which open the rosettes.

Prostates flattened, with mammillated surfaces in segment 18.

Sperm sacs, grape-like, on the anterior wall of segment 12, with a small pair on the anterior wall of segment 14.

Ovaries in segment 13, into which open the oviducts.

Spermathecæ, two pairs in segments 8 and 9. Each consisting of a large sac, with a pair of small rosette-like diverticula.

Habitat. Victoria (exact locality unknown).

(7) *M. incertus*, sp. n. (Figs. 52, 53, 54, 80). Length of spirit specimens 10 inches, one-quarter inch broad.

Prostomium completely dovetailed into the peristomium.

Clitellum, when fully mature, includes segments 13–18, but when not fully developed, only includes the posterior part of 13, and the anterior of 18.

Setæ arranged regularly in four couples, the rows of the outer couple, which is lateral in position, being about twice as far from one another as those of the inner couple.

Male pores on papillæ on segment 18, at the level of the interval between the setæ of the inner couples.

Oviduct pores on small papillæ on segment 14, anterior to, and ventral of, the level of the innermost setæ.

Spermathecal pores, two pairs on slight papillæ in the anterior part of segments 8 and 9, at the level of the interval between the setæ of the inner couples.

Accessory copulatory structures. A round tumid patch between the male pores. Elliptical elevations, with median depressions, situated at the level of the intervals between the setæ of the inner couples, and placed half on each of the segments 16 and 17, 19 and 20, 20 and 21, 21 and 22, 22 and 23.

Alimentary canal. Gizzard in segment 6. No true calciferous glands and no well marked vascular swellings. Large intestine commences in segment 18.

Circulatory system. Dorsal vessel single. Hearts in segments 6–12, those in segments 6–8 small.

Excretory system. Meganephric.

Reproductive system. Testes, two pairs in segments 10 and 11, rosettes opening into the same segments. Prostates, coiled, tubular, and in segment 18. Sperm sacs, grape-like, attached to the anterior wall of segment 12, and the posterior wall of segment 9.

Ovaries in segment 13, the oviducts opening into the same segment.

Spermathecæ, two pairs in segments 8 and 9, each consisting of a large sac with a very small diverticulum scarcely noticeable.

Habitat. Victoria (exact locality unknown).

(8) *Megascolides sinuosus*, sp. n. (Figs. 55, 56, 57). Length of spirit specimen 20 inches, slightly more than one-quarter inch broad.

Prostomium not at all dovetailed into the peristomium.

Clitellum only indicated by a slight colouration (in spirit) in the region about the genital openings, where also ridges are present.

Setæ, in four couples, the rows of the inner couple being close together, those of the outer far apart; the third row is lateral, and the fourth dorsal in position. The two outer rows are sinuously arranged in the middle and posterior parts of the body.

Male pores on slight elevations on segment 18.

Oviduct pores on segment 14, ventral of, and anterior to, the innermost setæ.

Spermathecal pores, two pairs between segments 7 and 8, 8 and 9.

Accessory copulatory structures. Two ridges, one half on segments 19 and 20, the other half on segments 20 and 21 ventrally.

Alimentary canal. Gizzard in segment 5. No true calciferous glands, but slightly vascular swellings in segments 13–17. Large intestine commences in segment 18.

Circulatory system. Dorsal blood-vessel single. Hearts in segments 7–13. Supra-intestinal and lateral blood-vessel in the region of the hearts.

Excretory system. Plectonephric. No large paired nephridia present.

Reproductive system. Testes, two pairs in segments 10 and 11, with rosettes in the same segments.

Prostates, coiled, tubular, in segment 18.

Sperm sacs, grape-like, attached to the anterior walls of segments 12 and 14, the former large.

Ovaries in segment 13, into which open the oviducts.

Spermathecæ, two pairs in segments 8 and 9, each consisting of a long sac, with a short diverticulum at the base.

Habitat. Dandenong Ranges. Collected by Mr. J. Hulme.

This is evidently very closely allied to *M. obscurus*, from which, however, it differs amongst other points, in the fact that the spermatheca has only one small diverticulum, whilst two are present in *M. obscurus*.

(9) *M. roseus*, sp. n. (Figs. 58, 59, 60, 81). Length of spirit specimen 7 inches (length when alive 10–12 inches), one-quarter inch broad.

Prostomium completely dovetailed into the peristomium. The latter ribbed.

Clitellum strongly marked, including segments 13–18, only the posterior dorsal part of the former, and the anterior

two annuli of the latter. Complete in segments 14, 15, and the posterior part of 13, and anterior of 16; saddle-shaped in segment 17, and the posterior part of 16, and anterior of 18. Bright pink colour when alive, the body being flesh-coloured.

Setæ, four couples, regularly arranged. The rows of setæ of each couples in the anterior median part of the body being very close together, and the outer ones latero-ventral in position. The rows gradually become wider apart posteriorly.

Male pores on papillæ on segment 18, at the level of the interval between the rows of setæ of the inner couples.

Oviduct pores on segment 14, ventral of, and anterior to, the level of the innermost setæ.

Spermathecal pores, two pairs, between segments 7 and 8, 8 and 9.

Accessory copulatory structures. Swollen, round, tumid patch between the male pores. In front of these, on segment 17, are two round elevations, each at the level of the interval between the rows of the inner couples of setæ. Elliptical elevations, with median depressions, placed half on each of the segments 19 and 20, 20 and 21, 21 and 22, 22 and 23.

Dorsal pores present, but not visible in front of the clitellum, and may be obliterated in this.

Nephridiopores at the level of the third row of setæ.

Alimentary canal. Gizzard in segment 5. Two large pairs of calciferous glands in segments 15 and 16. The large intestine commences in segment 18.

Circulatory system. Dorsal vessel single. The last heart in segment 12 A supra-intestinal vessel present in the region of the hearts.

Excretory system. Meganephric.

Reproductive system. Two pairs of testes in segments 10 and 11, with rosettes in the same segments. Prostates, coiled, tubular, and in segments 17, 18, and 19. White elevated patches are seen in segments 18, 19, 20, 21, and 22, corresponding in position to the accessory copulatory structures seen externally. Sperm sacs, grape-like, attached to the anterior wall of segment 12.

Ovaries in segment 13, into which also open the oviducts.

Spermathecæ, two pairs in segments 8 and 9, each with a large sac and small rosette-like diverticulum.

Habitat. Warragul, about one foot under ground.

(10) *M. attenuatus*, sp. n. (Figs. 61, 62, 82). Length of spirit specimen 6–8 inches. Only one-eighth inch broad at most, and often only half of this. Very thin and attenuate; more than one foot long when alive. Dull greyish colour when alive.

Prostomium not at all dovetailed into the peristomium.

Clitellum purple in spirit specimens, and well marked, occupying segments 13–18, but not complete on the ventral surface of the latter.

Setæ in four couples, the interval between the rows of the outer couple, which are lateral in position, being slightly greater than that between the rows of the inner couple. The fourth row slightly irregular in the last ten segments, and coming to lie dorsally.

Male pores, inconspicuous, on segment 18.

Oviduct pores on segment 14, ventral of, and anterior to, the level of the innermost setæ.

Spermathecal pores, two pairs, between segments 7 and 8, 8 and 9.

Dorsal pores present, the first between segments 5 and 6; obliterated in the clitellar region.

Alimentary canal. Gizzard in segment 5. No true calciferous glands.

Circulatory system. Dorsal vessel single, the last heart in segment 12.

Excretory system. Meganephric.

Testes difficult to determine exactly, but almost certainly two pairs in segments 10 and 11, into which open two distinct pairs of rosettes.

Prostates, coiled, tubular, in segment 18. Around each prostatic duct lies a curious structure, consisting of minute grape-like processes.

Sperm sacs, grape-like, attached to the anterior wall of segment 12, and the posterior of segment 9.

Ovaries in segment 13, with oviducts opening into the same segment.

Spermathecæ, two pairs, in segments 8 and 9, each with a long sac and small diverticulum.

Habitat. Warragul, Gippsland. Obtained by digging in gullies, and found along with *Megascolides australis*, *tuberculatus*, *manni*, *roseus*, &c. Always some distance under ground.

(11) *M. australis* (McCoy).

The first description of this was published by Professor Sir F. McCoy in the Prodromus of the Zoology of Victoria.* It was subsequently re-described by Mr. Fletcher† under the name of *Notoscolex gippslandicus*, and its anatomy described by myself in the Transactions of the Royal Society of Victoria.‡

(12) *M. tuberculatus* (Fletcher).

This has been described by Mr. Fletcher§, who obtained it from Warragul. I have since obtained it from Camperdown, Victoria.

DESCRIPTION OF PLATES 14, 15, 16, 17, 18, 19.

The Plates contain diagrammatic drawings representing the arrangement of the various organs and parts mentioned in the foregoing account in each different species. In the case of each species one drawing represents the external anatomy, a second the alimentary canal, circulatory system and the disposition of the nephridia, and a third the reproductive organs. On Plate 19, the spermathecæ are drawn in outline (under the camera lucida, × 4).

REFERENCE LETTERS.

Acc.	Accessory copulatory structures.	*Ovd.*	Oviduct.
Calc.	Calciferous glands.	*Pr.*	Prostate gland.
Clt	Clitellum.	*R.*	Sperm rosette.
D.Bv.	Dorsal blood-vessel.	*Spth.*	Spermathecæ.
Gz.	Gizzard.	*T.*	Testis.
Hts.	Hearts.	*Vasc.*	Vascular swellings on œsophagus.
L.	Intestine.	*V.S.*	Sperm sacs.
Ov.	Ovary.		

* Decade I.

† Notes on Aust. Earth-worms. Proc. Linn. Soc. N.S.W., Vol. II (Series 2nd), 1887, p. 603.

‡ Trans. R. S. Victoria, Part I, 1888.

§ *Loc. cit.*, p. 611.

ART. XVIII.—*Catalogue of Algæ collected at or near Port Phillip Heads and Western Port.*

By J. BRACEBRIDGE WILSON, M.A., F.L.S.

LIST OF ABBREVIATIONS USED.

Kütz., Sp. Alg.	..	**Species Algarum, by F. T. Kützing.**
J. Ag., S. G. et O. Alg.	..	**Species, Genera, et ordines Algarum, by J. G. Agardh.**
Harv., Phyc. Aus...	..	**Phycologia Australica, by W. H. Harvey.**
J. Ag., Alg. Syst. ..	..	**Till Algernes Systematik, by J. G. Agardh.**
J. Ag., Sp. Sarg. ..	..	**Species Sargassorum, by J. G. Agardh.**
J. Ag., Flor. Morph.	..	**Florideernes Morphologi, by J. G. Agardh.**

*** An Asterisk prefixed, indicates that the genus or species was previously unknown.**

MELANOSPERMEÆ (FUCOIDEÆ.)

Ordo I. FUCACEÆ.

SARGASSUM.

S. biforme, Sond. Kütz., Sp. Alg., 625.
J. Ag., S. G. et O. Alg., I, 301.
J. Ag., Alg. Syst., Part I, 67.
J. Ag., Sp. Sarg., 75.
S. cristatum, J. Ag. J. Ag., Sp. Sarg., 84.
S. fallax, Sond. Kütz., Sp. Alg., 301.
J. Ag., S. G. et O. Alg., I, 297.
J. Ag., Sp. Sarg., 68.

S. gunnianum, J. Ag. J. Ag., Sp. Sarg., 71.
S. lævigatum, J. Ag. J. Ag., Sp. Sarg., 67.
S. sonderi, J. Ag. J. Ag., Sp. Sarg., 44.
Harv., Phyc. Aus., V, pl. 243. Sub nomine Cystophora Sonderi.
S. teretifolium, J. Ag. J. Ag., S. G. et O. Alg., I, 331.
J. Ag., Sp. Sarg., 101.
S. verruculosum, J. Ag. J. Ag., Sp. Sarg., 53.

SEIROCOCCUS.

S. axillaris, Grev. Kütz., Sp. Alg., 593.
J. Ag., S. G. et O. Alg., I, 260. Harv., Phyc. Aus., I, pl. 4.

PHYLLOSPORA.

P. comosa, J. Ag. Kütz., Sp. Alg., 592.
J. Ag., S. G. et O. Alg., I, 253. Harv., Phyc. Aus., III, pl. 153.

SCABERIA.

S. agardhii, Grev. Kütz., Sp. Alg., 636. Sub nomine Castraltia salicornoides. J. Ag., S. G. et O. Alg., 252.
Harv., Phyc. Aus., III, pl. 164.

CYSTOPHORA.

C. cephalornithos, J. Ag. J. Ag., S. G. et O. Alg. I, 246.
Harv., Phyc. Aus., II, pl. 116.
C. paniculata, J. Ag. J. Ag., S. G. et O. Alg., I, 248.
Harv., Phyc. Aus., V, pl. 247.
C. platylobium, J. Ag. J. Ag.. S. G. et O. Alg., I, 245.
C. sonderi, J. Ag. J. Ag., S. G. et O. Alg., I, 247.
Harv., Phyc. Aus., V, pl. 243.
C. spartioides, J. Ag. J. Ag., S. G. et O. Alg., I, 244.
Harv., Phyc. Aus., II, pl. 76.
C. subfarcinata, Mert. Kütz., Sp. Alg., 628. Sub nomine Blossevillea subfarcinata. J. Ag., S. G. et O. Alg., I, 240.
C. torulosa, Br. Kütz., Sp. Alg., 628. Sub nomine Blossevillea.
J. Ag., S. G. et O. Alg., I, 243.

CYSTOPHYLLUM.

C. muricatum, J. Ag. Kütz., Sp. Alg. Sub nomine Sirophysalis muricata. J. Ag., S. G. et O. Alg., I, 231.
Harv., Phyc. Aus., III, pl. 139.

CAULOCYSTIS.

C. uvifera, Areschong. Kütz., Sp. Alg. Sub nomine Blossevillea uvifera. J. Ag., S. G. et O. Alg., I, 246. Sub nomine Cystophora.
Harv., Phyc. Aus., III, pl. 175.

FUCODIUM.

F. chondrophyllum, J. Ag. J. Ag., S. G. et O., Alg., I, 203.

HORMOSIRA.

H. banksii, Decaisne. Kütz., Sp. Alg., 586. J. Ag., S. G. et O. Alg., I, 198.
Harv., Phyc. Aus., III, pl. 135.

CARPOGLOSSUM.

C. confluens, J. Ag. Kütz., Sp. Alg., 591.
J. Ag., S. G. et O. Alg., I, 195.
Harv., Phyc. Aus., III, pl. 159.

MYRIODESMA.

* M. calophyllum, J. Ag. Ms., spec. nov., 1887.
M. integrifolium, Harv. J. Ag., Alg. Syst., VI, p. 6.
M. pinnatifidum, J. Ag. Hodie forma M. integrifolii potius videtur laciniis in rachide costata magis conspicue in folium pinnatifidum conjunctis.
M. quercifolium, J. Ag. Kütz., Sp. Alg., 588.
J. Ag., S. G. et O. Alg., I, 192. J. Ag., Alg. Syst., VI, p. 7.

SARCOPHYCUS.

S. potatorum, Labill. Kütz., Sp. Alg., 588.
J. Ag., S. G. et O. Alg., I, 190.
Harv., Phyc. Aus. Sub nomine d'Urvillea potatorum, V, pl. 300.

SPLACHNIDIUM.

S. rugosum, Grev. Kütz., Sp. Alg., 585.
J. Ag., S. G. et O. Alg., I, 186.
Harv., Phyc. Aus., I, pl. 14.

NOTHEIA.

N. anomala, Harv. Harv., Phyc. Aus., IV, pl. 213.

Ordo II. SPOROCHNOIDEÆ.

CARPOMITRA.

C. cabreræ, Kütz. Kütz., Sp. Alg., 569.
J. Ag., S. G. et O. Alg., I, 177.

BELLOTIA.

B. eriophorum, Harv. Harv., Phyc. Aus., II, pl. 69.

PERITHALIA.

P. inermis, J. Ag. Kütz., Sp. Alg., 570.
J. Ag., S. G. et O. Alg., I, 178. Harv., Phyc. Aus., IV, pl. 238.

NEREIA.

N. australis, Harv. Harv., Flor. Tasm., II, pl. 188.
N. filiformis, Zan. Kütz., Sp. Alg. Sub nomine Clatothele filiformis. J. Ag., S. G. et O. Alg., I, 175. Sub nom. Sporochnus.
* N. lophocladia, J. Ag. Ms., spec. nov., 1889.

SPOROCHNUS.

S. apodus, Harv. Flor. Tasm., II, pl. 287.
S. comosus, Ag. J. Ag., S. G. et O. Alg., I, 174.
Harv., Phyc. Aus., II, pl. 104.
S. moorei, Harv. Harv., Phyc. Aus., 1, pl. 19.
S. pedunculatus, Harv. J. Ag., S. G. et O. Alg., I, 174.
S. radiciformis, Ag. J. Ag., S. G. et O. Alg., I, 175.
Harv., Phyc. Aus., IV, pl. 225.

DESMARESTIA.

* D. obtusa, J. Ag. Ms., sp. nov., 1885 (Western Port).

Ordo III. LAMINARIEÆ.

MACROCYSTIS.

M. pyrifera, Ag. Kütz., Sp. Alg., 582.
J. Ag., S. G. et O. Alg., I, 156. Harv., Phyc. Aus., IV, pl. 202.

ECKLONIA.

E. radiata, J. Ag. J. Ag., S. G. et O. Alg., I, 146.

CHORDA.

C. lomentaria, Lyngb. Kütz., Sp. Alg., 548.
J. Ag., S. G. et O. Alg., I, 126. Sub. nomine Scytosiphon lomentarium.

Ordo IV. DICTYOTEÆ.

HALYSERIS.

H. acrostichoides, J. Ag. J. Ag., Alg. Syst., II, p. 133.
H. muelleri, Sond. J. Ag., Alg. Syst., II, p. 132.
Harv., Phyc. Aus., III, pl. 180.

PADINA.

P. commersoni, J. Ag. Kütz., Sp. Alg., 565.
J. Ag., S. G. et O. Alg., I, 113,
P. pavonia, Gaillon. Kütz., Sp. Alg., 565.
J. Ag., S. G. et O. Alg., I, 113.

ZONARIA.

Z. crenata, J. Ag. J. Ag., Alg. Syst., I, p. 48.
Z. flava, Harv. Kütz., Sp. Alg., 563. Sub nomine Stypopodium flavum.
J. Ag., S. G. et O. Alg., I, 110. J. Ag., Alg. Syst., I, p. 49.
Z. microphylla, Harv. J. Ag., Alg. Syst., I, p. 49.
Harv., Phyc. Aus., IV., pl. 195.
Z. nigrescens, Sond. Kütz., Sp. Alg., 561. J. Ag., S. G. et O. Alg., I, 108. J. Ag., Alg. Syst., I, p. 46.
Z. stuposa, J. Ag. Kütz., Sp. Alg., 564. J. Ag., S. G. et O. Alg., I, 110. J. Ag., Alg. Syst., I, p. 50.
Z. turneriana, J. Ag. J. Ag., Alg. Syst., I, p. 48.

LOBOSPIRA.

L. bicuspidata, Aresch. Harv., Phyc. Aus., I, pl. 34.

CUTLERIA.

C. multifida, Grev. Kütz., Sp. Alg., 558.
J. Ag., S. G. et O. Alg., I, 104.

TAONIA.

T. atomaria, J. Ag. Kütz., Sp. Alg., 563. Sub genere Stypopodium. J. Ag., S. G. et O. Alg., I, 101.

SPATOGLOSSUM.

S. australasicum, J. Ag. J. Ag., Alg. Syst., II, p. 113.
* S. cuneatum, J. Ag. Ms., Species nova, 1886.

DILOPHUS.

D. fastigiatus, Kütz. J. Ag., Alg. Syst., II, p. 107.
Harv., Phyc. Aus., II, pl. 82.
D. foliosus, J. Ag. Ms.
D. gunnianus, J. Ag. J. Ag., Alg. Syst., II, p. 106.
D. opacus, J. Ag. J. Ag., Alg. Syst., II, p. 107.
D. tener, J. Ag. Ms., nondum descripta.
* D. wilsoni, J. Ag. Ms., species nova, 1884.

DICTYOTA.

D. abyssinica, Kütz. Tab. Phyc., Vol. IX, tab. 21.
D. apiculata, J. Ag. Ms., nondum descripta.
D. dichotoma, J. Ag. J. Ag., S. G. et O. Alg., I, 92.
J. Ag., Alg. Syst., II, p. 92.
D. diemensis, Sond. J. Ag., Alg. Syst., II, p. 97.
D. foliolosa, J. Ag. Ms., nondum descripta.
D. furcellata, J. Ag. J. Ag., S. G. et O. Alg., I, 90.
J. Ag., Alg. Syst., II, p. 102.
Harv., Phyc. Aus., I, pl. 38.
D. nigricans, J. Ag. J. Ag., Alg. Syst., II, p. 94.
D. paniculata, J. Ag. J. Ag., S. G. et O. Alg. 91.
J. Ag., Alg. Syst., II, p. 105.
D. pellucida, J. Ag. Ms., nondum descripta.
D. pinnatifida, J. Ag. J. Ag., Alg. Syst., II, p. 100.
D. radicans, Harv. J. Ag., Alg. Syst., II, p. 92.
Harv., Phyc. Aus., II, pl. 119.

STILOPHORA.

S. lyngbyei, J. Ag. Kütz., Sp. Alg., 549. Sub nomine Spermatochnus paradoxus. J. Ag., S. G. et O. Alg., I, 84.

ASPEROCOCCUS.

A. sinuosus, Bory. Kütz., Sp. Alg., 552. Sub nomine Encœlium sinuosum. J. Ag., S. G. et O. Alg., I, p. 75.
A. turneri, Harv. Kütz., Sp. Alg., 552. J. Ag., S. G. et O. Alg., I, 77. Sub nomine A. bullosus.

Ordo V. CHORDARIEÆ.

POLYCEREA.

P. ramulosa, J. Ag. J. Ag., Alg. Syst., II, p. 48.

BACTROPHORA.

B. nigrescens, J. Ag. J. Ag., Alg. Syst., II, p. 26.

Ordo VI. SPHACELARIEÆ.

CLADOSTEPHUS.

C. spongiosus, Harv. J. Ag., S. G. et O. Alg., I, 43.
C. verticillatus, Ag. Kütz., Sp. Alg., 469. J. Ag., S. G. et O. Alg., I, 43.

SPHACELARIA.

S. paniculata, Lb. Kütz., Sp. Alg., 467. J. Ag., S. G. et O. Alg., I, 36.

Ordo VII. ECTOCARPEÆ.

ECTOCARPUS.

E. fasciculatus, Harv. Kütz., Sp. Alg., 452. J. Ag., S. G. et O. Alg., I, 22.
E. giraudiæ, J. Ag. Ms.
E. siliculosus, Harv. Kütz., Sp. Alg., 453. Sub nomine E. gracillimus. J. Ag., S. G. et O. Alg., I, 22.
E. sordidus, Harv. Flor. Tasm, II, p. 294.

RHODOSPERMEÆ (FLORIDEÆ.)

Ordo I. RHODOMELEÆ.

CLAUDEA.

C. elegans, Lamour. Kütz., Sp. Alg., 888.
J. Ag., S. G. et O. Alg., II, 1275.
J. Ag., Flor. Morph., XXXII, 30–33.
Harv., Phyc. Aus., I, pl. 1.

SARCOMENIA.

S. dasyoides, Harv. J. Ag., S. G. et O. Alg., II, 1263.
S. delesserioides, Sond. Kütz., Sp. Alg., 880.
J. Ag., S. G. et O. Alg., II, 1266.
Harv., Phyc. Aus., III, pl. 121.
S. tenera, J. Ag. Harv., Phyc. Aus., V, pl. 257.
S. victoriæ, J. Ag. J. Ag., S. G. et O. Alg., II, 1262.

HANOVIA.

H. arachnoidea, Harv. J. Ag., S. G. et O. Alg., II, 1254.
Harv., Phyc. Aus., I, pl. 37. Sub nom. Halodictyon.
H. robusta, Harv. J. Ag., S. G. et O. Alg., II, 1254.
Harv., Phyc. Aus., I, pl. 37.

TRIGENEA.

T. umbellata, J. Ag. J. Ag., Alg. Syst., VI, 116.

DICTYURUS.

D. quercifolius, Decaisne. Kütz., Sp. Alg., 673. Sub nom. Thuretia. J. Ag., S. G. et O. Alg., II, 1245. Harv., Phyc. Aus., I, pl. 40.
D. teres, J. Ag. J. Ag., S. G. et O. Alg., II, 1244.
Harv., Phyc. Aus., IV, pl. 191.

DASYA.

* D. atactica, J. Ag. J. Ag., Alg. Syst., VI, p. 107. Species nova, 1886.
D. ceramioides, J. Ag. Kütz., Sp. Alg., 801. Sub nom. Trichothamnion ceramioides. J. Ag., S. G. et O. Alg., II, 1187. J. Ag., Alg. Syst., VI, p. 106.

* D. dictyuroides, J. Ag. Species nova, 1886. Olim dictyurus gymnopus.
J. Ag., Alg. Syst., VI, p. 111.
D. gunniana, Harv. Kütz., Sp. Alg., 798. Sub nomine Eupogonium gunnianum.
J. Ag., Alg. Syst., VI, p. 85. J. Ag., S. G. et O. Alg., II, 1200.
D. gunniana v. laurenciana, Harv. Kütz., Sp. Alg., 832.
J. Ag., S. G. et O. Alg., II, 1201.
D. haffiæ, Harv. J. Ag., S. G. et O. Alg., II, 1237.
J. Ag., Alg. Syst., VI, p. 97. Harv., Phyc. Aus., III, pl. 143.
D. hapalathrix, Harv. J. Ag., S. G. et O. Alg., 1211.
J. Ag., Alg. Syst., VI, p. 96. Harv., Phyc. Aus., II, pl 88.
* D. microcladioides, J. Ag. Species ad D. pellucidam olim relata. J. Ag., Alg. Syst., VI, p. 82.
D. muelleri, Sond. J. Ag., S. G. et O. Alg., II. 1196.
J. Ag., Alg. Syst., VI, p. 84. Harv., Phyc. Aus., I, pl. 31.
D. naccarioides, Harv. J. Ag., S. G. et O. Alg., II, 1217.
J. Ag., Alg. Syst., VI, p. 100.
D. villosa, Harv. J. Ag., S. G. et O. Alg., II, 1215.
J. Ag., Alg. Syst., VI, p. 103.
D. villosa v. macroura, Harv. Sub D. villosâ species duo confusas potius crederem.
* D. wilsonis, J. Ag. Species nova, 1885.
J. Ag., Alg. Syst., VI, p. 88.
D. wrangelioides, Harv. J. Ag., S. G. et O. Alg., 1192.
J. Ag., Alg. Syst., VI, p. 86. Harv., Phyc. Aus., III, pl. 174.

LOPHOTHALIA.

L. australis, J. Ag. Olim Polysiphonia australis, aut P. cladostephus. J. Ag., S. G. et O. Alg., II, 1044. J. Ag., Alg. Syst., VI, p. 59.
Harv., Phyc. Aus., III, pl. 154.
L. bolbochæte, J. Ag. Olim Dasya bolbochæte.
J. Ag., S. G. et O. Alg., II, 1233. J. Ag., Alg. Syst., VI, p. 63.
L. feredayæ, J. Ag. Olim dasya. f. J. Ag., S. G. et O. Alg. II, 1235. J. Ag., Alg. Syst., VI, p. 62.
Harv., Phyc. Aus., III, pl. 173.

L. hormoclados, J. Ag. = Dasya. h. J. Ag., S. G. et O. Alg., II, 1188. J. Ag., Alg. Syst., VI, p. 59.
L. verticillata, J. Ag. = Dasya. v. J. Ag., S. G. et O. Alg., II, 1234. J. Ag., Alg. Syst., VI, p. 61.

POLYZONIA.

P. flaccida, Harv. J. Ag., S. G. et O. Alg., II, 1165.
J. Ag., Flor. Morph., XXXII, 24. Harv., Phyc. Aus., I, pl. 42.
P. incisa, J. Ag. Kütz., Sp. Alg., 882.
J. Ag., S. G. et O. Alg., II, 1165.
Harv., Phyc. Aus., I, pl. 42.

CLIFTONÆA.

C. pectinata, Harv. J. Ag., S. G. et O. Alg., II, 1160.
J. Ag., Flor. Morph., XXXII, 22.
Harv. Phyc. Aus., II, pl. 100.

POLYPHACUM.

P. smithiæ, Harv. Kütz., Sp. Alg., 878. Sub nomine Epiglossum smithii.
J. Ag., S. G. et O. Alg., II, 1132.

LENORMANDIA.

L. chauvinii, Harv. J. Ag., S. G. et O. Alg., II, 1104.
L. marginata, Harv. J. Ag., S. G. et O. Alg., II, 1107.
Harv., Phyc. Aus., IV, pl. 235.
L. muelleri, Harv. J. Ag., S. G. et O. Alg., II, 1105.
Harv., Phyc. Aus., I, pl. 45.
L. prolifera, J. Ag. J. Ag., S. G. et O. Alg., II, 1103.
Harv., Phyc. Aus., V, pl. 246.

RYTIPHLÆA.

R. australasica, Kütz., Sp. Alg., 841. Sub nomine Halopithys a. J. Ag., S. G. et O. Alg., II, 1192.
Harv., Phyc. Aus., I, pl. 27.
R. elata, Sond. J. Ag., S. G. et O. Alg., II, 1088.
J. Ag., Alg. Syst., IV, p. 106.
Harv., Phyc. Aus., IV, pl. 236.
R. umbellata, J. Ag. Ms., hanc speciem nusquam invenio descriptam.

DICTYMENIA.

D. harveyana, Sond. J. Ag., S. G. et O. Alg., II, 1079.
J. Ag., Alg. Syst., IV, p. 104.
D. tridens, Kütz., Sp. Alg., 848. J. Ag., S. G. et O. Alg., II, 1081.
J. Ag., Alg. Syst., IV, p. 105.

POLYSIPHONIA.

P. blandi, Harv. J. Ag., S. G. et O. Alg., II, 976.
Harv., Phyc. Aus., IV, pl. 184.
P. cancellata, Harv. Kütz., Sp. Alg., 815.
J. Ag., S. G. et O. Alg., 1049. J. Ag., Flor. morph., XXXIII, 7–8.
P. frutex, Harv. Kütz., Sp. Alg., 815.
J. Ag., S. G. et O. Alg., 1047.
P. hookeri, Harv. Kütz., Sp. Alg., 832. J. Ag., S. G. O. Alg., II, 1019.
P. hystrix, Harv. Kütz., Sp. Alg., 832. J. Ag., S. G. et O. Alg., II, 1017.
P. laxa, Harv. Kütz., Sp. Alg., 827. J. Ag., S. G. et O. Alg., II, 1071.
P. lyallii, Harv. Kütz., Sp. Alg., 837. J. Ag., S. G. et O. Alg., II, 1021.
P. mallardiæ, Harv. Kütz., Sp. Alg., 834. J. Ag., S. G. et O. Alg., II, 1020.
P. mollis, Harv. Kütz., Sp. Alg., 823. J. Ag., S. G. et O. Alg., II, 968.
P. pectinella, Harv. J. Ag., S. G. et O. Alg., II, 918.
P. pennata, Harv. Kütz., Sp. Alg., 803.
J. Ag., S. G. et O. Alg., II, 928.
P. rostrata, Harv. Kütz., Sp. Alg., 809.
J. Ag., S. G. et O. Alg., II, 926.
P. rufolanosa Harv. J. Ag., S. G. et O. Alg., II, 939.
* P. sphacelarioides, J. Ag. Species nova, 1887.
J. Ag., Alg. Syst., IV, p. 100.
P. spinosissima, Harv. J. Ag., S. G. et O. Alg., II, 1045.
Harv., Phyc. Aus., III, pl. 155.
P. succulenta, Harv. Kütz., Sp. Alg., 824. Sub nomine P. subtilis. J. Ag., S. G. et O. Alg., II, 968.
P. versicolor, Hook. et Harv. Kütz., Sp. Alg., 805.
J. Ag., S. G. et O. Alg., II, 922.

RHODOMELA.

R. periclada, Sond. J. Ag., S. G. et O. Alg., II, 878.
Harv., Phyc. Aus., I, pl. 28.

ALSIDIUM.

A. comosum, Harv. Harv., Phyc. Aus., V, pl. 270.
J. Ag., Alg. Syst., VI, p. 52.

JEANNERETTIA.

J. lobata, Hook. et Harv. Kütz., Sp. Alg., 881. Sub nomine Botryoglossum lobatum.
J. Ag., S. G. et O. Alg., II, 837. J. Ag., Flor. Morph., XXXIII, 20–23. Harv., Phyc. Aus., I, pl. 33.

MELANOSERIS.

M. crispata, Zanard. Phyceæ australicæ novæ, Z.

POLLEXFENIA.

* P. crenata, J. Ag. Ms., species nova, 1891.
* P. nana, J. Ag. Ms., species nova, 1891.
P. pedicellata, Harv. Kütz., Sp. Alg., 875.
J. Ag., S. G. et O. Alg., II, 834.

MARTENSIA.

M. australis, Harv. J. Ag., S. G. et O. Alg., II, 827.
Harv., Phyc. Aus., I, pl. 8.
M. elegans, Harv. Kütz., Sp. Alg., 888.
J. Ag., S. G. et O. Alg., II, 828.

ACANTHOPHORA.

A. arborea, Harv. J. Ag., S. G. et O. Alg., II, 822.
Harv., Phyc. Aus., III, pl. 132.

CHONDRIOPSIS.

* C. arborescens, J. Ag. Ms., species nova, 1891.
C. debilis, J. Ag. = Chondria debilis, Harv.
Harv., Syn. Cat., 206.
* C. foliifera, J. Ag. Species nova, 1882.
J. Ag., Alg. Syst., IV, p. 90.
C. fusifolia, J. Ag. = Chondria fusifolia, Harv.
Harv., Syn. Cat., 207.
C. harveyana, J. Ag. J. Ag., S. G. et O. Alg., 808.
* C. ovalifolia, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., VI, p. 48.
* C. succulenta, J. Ag. Ms., species nova, 1883.

Ordo II. CHONDRIEÆ.

* HALITÆNIA.

* H. wilsonis, J. Ag. Species nova, 1890. Ms.

LEPTOPHYLLIS.

L. conferta, J. Ag. J. Ag., S. G. et O. Alg., III, 676.
Harv., Phyc. Aus., III, pl. 144. Sub nomine Cladhymenia conferta.

PTILONIA.

P. australasica, Harv. J. Ag., S. G. et O. Alg., III, 674.
* P. subulifera, J. Ag. Species nova, 1887.
J. Ag., Alg. Syst., VI, p. 46.

DELISEA.

D. elegans, J. Ag. Kütz., Sp. Alg., 670. Sub nomine Rhodocallis elegans. J. Ag., S. G. et O. Alg., III, 670.
D. hypneoides, Harv. J. Ag., S. G. et O. Alg., III, 670.
Harv., Phyc. Aus., III, pl. 134.
D. pulchra, Grev. Kütz., Sp. Alg., 770.
J. Ag., S. G. et O. Alg., III, 671.
Harv., Phyc. Aus., I, pl. 16.

BONNEMAISONIA.

B. asparagoides, J. Ag. Kütz., Sp. Alg., 842.
J. Ag., S. G. et O. Alg., III, 669.

ASPARAGOPSIS.

A. armata, Harv. J. Ag., S. G. et O. Alg., III, 666.
Harv., Phyc. Aus., IV, pl. 192.
A. delilei, Harv. Kütz., Sp. Alg., 802.
J. Ag., S. G. et O. Alg., III, 666.

LAURENCIA.

L. dendroidea, J. Ag. J. Ag., S. G. et O. Alg., III, 650.
L. elata, Harv. J. Ag., S. G. et O. Alg., III, 659.
L. forsteri, Grev. J. Ag., S. G. et O. Alg., III, 645.
L. grevilleana, Harv. J. Ag., S. G. et O. Alg., III, 661.
Harv., Phyc. Aus., I, pl. 15.
L. obtusa, Grev. J. Ag., S. G. et O. Alg., III, 653.

CORYNECLADIA.

C. umbellata, J. Ag. J. Ag., S. G. et O. Alg., III, 643.

COELOCLONIUM.

C. opuntioides, Harv. J. Ag., S. G. et O. Alg., III, 640.
C. verticillatum, Harv. J. Ag., S. G. et O. Alg., III, 640.
Harv., Phyc. Aus., II, pl. 102. Sub nomine Chondria verticillata.

Ordo III. WRANGELIEÆ.

WRANGELIA.

W. ballioides, J. Ag. J. Ag., S. G. et O. Alg., III, 621.
W. clavigera, Harv. J. Ag., S. G. et O. Alg., III, 621.
Harv., Phyc. Aus., V, pl. 287.
W. crassa, Hook. et Harv. Kütz., Sp. Alg., 665.
J. Ag., S. G. et O. Alg., III, 620.
W. halurus, Harv. J. Ag., S. G. et O. Alg., 619.
Harv., Phyc. Aus., II, pl. 70.
* W. incurva, J. Ag. Ms., species nova, 1886.
W. mucronata, Harv. J. Ag., S. G. et O. Alg., III, 616.
W. nitella, Harv. J. Ag., S. G. et O. Alg., III, 616.
Harv., Phyc. Aus., II, pl. 105.
W. nobilis, Harv. Kütz., Sp. Alg., 665.
J. Ag., S. G. et O. Alg., III, 622.
W. plumosa, Harv. Kütz., Sp. Alg., 664.
J. Ag., S. G. et O. Alg., III, 624.
W. princeps, Harv. J. Ag., S. G. et O. Alg., III, 624.
Harv., Phyc. Aus., IV, pl. 234.
W. protensa, Harv. J. Ag., S. G. et O. Alg., III, 619.
W. setigera, Harv. J. Ag., S. G. et O. Alg., III, 622.
J. Ag., Flor. Morph., XXXII, 3.
W. velutina, Harv. J. Ag., S. G. et O. Alg., III, 617.
J. Ag., Flor. Morph., XXXII, 1–2.
Harv., Phyc. Aus., I, pl. 46.
W. verticillata, Harv. Kütz., Sp. Alg., 664.
J. Ag., S. G. et O. Alg., III, 619.

BORNETIA.

B. meredithiana, J. Ag. J. Ag., S. G. et O. Alg., III, 614

MONOSPORA.

M. australis, Harv. J. Ag., S. G. et O. Alg., III, 610.
Harv., Phyc. Aus., V, pl. 253. Sub nomine Corynospora australis.

Ordo IV. SOLIERIEÆ.

RHABDONIA.

R. charoides, Harv. J. Ag., S. G. et O. Alg., III, 594.
Harv., Phyc. Aus., IV, pl. 196.
R. clavigera, J. Ag. J. Ag., S. G. et O. Alg., III, 594.
R. coccinea, Harv. Kütz., Sp. Alg., 723.
J. Ag., S. G. et O. Alg., III, 591. Harv., Phyc. Aus., I, pl. 54.
R. dendroides, Harv. J. Ag., S. G. et O. Alg., III, 591.
Harv., Phyc. Aus., III, pl. 152.
R. mollis, Harv. J. Ag., S. G. et O. Alg., III, 593.
R. nigrescens, Harv. Kütz., Sp. Alg., 723.
J. Ag., S. G. et O. Alg., III, 590.
R. robusta, Grev. J. Ag., S. G. et O. Alg., III, 592.
Harv., Phyc. Aus., III, pl. 149. Sub nomine Solieria australis.
R. verticillata, Harv. J. Ag., S. G. et O. Alg., III, 594.
Harv., Phyc. Aus., V, pl. 299.

Ordo V. HYPNEACEÆ.

ECTOCLINIUM.

E. dentatum, J. Ag. J. Ag., S. G. et O. Alg., III, 575.
J. Ag., Flor. Morph., XXX, 1–8.

MYCHODEA.

M. carnosa, Harv. Kütz., Sp. Alg., 723.
J. Ag., S. G. et O. Alg., III, 571. Harv., Phyc. Aus., III, pl. 142.
* M. decipiens, J. Ag. Ms., species nova, 1887.
M. foliosa, Harv. J. Ag., S. G. et O. Alg., III, 573.
Harv., Phyc. Aus., IV, pl. 194. Sub nomine Gymnogongrus foliosus.
M. hamata, J. Ag. J. Ag., S. G. et O. Alg., 572.
Harv., Phyc. Aus., III, pl. 141. Sub nomine Acanthococcus ewingii.
M. terminalis, Harv. J. Ag., S. G. et O. Alg., III, 570.
Harv., Phyc. Aus., IV, pl. 200.

MERRIFIELDIA.

M. ramentacea, J. Ag. J. Ag., Alg. Syst., IV, p. 56.

HYPNEA.

H. australis, J. Ag. J. Ag., S. G. et O. Alg., III, 563.
Sub nomine H. divaricata.
H. episcopalis, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 561.
Harv., Phyc. Aus., I, pl. 23.
H. musciformis, J. Ag. J. Ag., S. G. et O. Alg., III, 561.
H. ramentacea, J. Ag. J. Ag., S. G. et O. Alg.. III, 561.
H. seticulosa, J. Ag. J. Ag., S. G. et O. Alg., III, 562.
J. Ag., Flor. Morph., XXIX, 13–16.

GATTYA.

G. pinnella, Harv. J. Ag., S. G. et O. Alg., III, 560.
Harv., Phyc. Aus., II, pl. 93.

Ordo VI. GELIDIEÆ.

GELIDIUM.

G. asperum, Harv. J. Ag., S. G. et O. Alg., III, 551.
G. australe, J. Ag. J. Ag., S. G. et O. Alg., III, 550.
G. corneum, Auch. J. Ag., S. G. et O. Alg., III, 549.
J. Ag., Flor. Morph., XXIX, 7–8.
G. glandulæfolium, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 551.
Harv., Phyc. Aus., I, pl. 18.

PTEROCLADIA.

P. lucida, J. Ag. J. Ag., S. G. et O. Alg., III, 545.
Harv., Phyc. Aus., V, pl. 248.

Ordo VII. CHÆTANGIEÆ.

ACROTYLUS.

A. australis, J. Ag. J. Ag., S. G. et O. Alg., III, 541.
J. Ag., Flor. Morph., XXIX, 2–6.
Harv., Phyc. Aus., II, pl. 99.

BINDERA.

B. splachnoides, Harv. J. Ag., S. G. et O. Alg., III, 536.
Harv., Phyc. Aus., II, pl. 111.
J. Ag., Alg. Syst., IV, p. 46.

Ordo VIII. HELMINTHOCLADIACEÆ.

GALAXAURA.

G. marginata, Lamour. J. Ag., S. G. et O. Alg., III, 534. Sub nom. Zanardinia marginata.
Harv., Phyc. Aus., III, pl. 136.

LIAGORA.

L. australasica, Sond. Kütz., Sp. Alg., 538.
L. viscida, Ag. Kütz., Sp. Alg., 538.
J. Ag., S. G. et O. Alg., III, 518.

SCINAIA.

S. furcellata, Biv. J. Ag., S. G. et O. Alg., III, 512.
* S. moniliformis, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., IV., p. 72.

GLOIOPHLÆA.

G. scinaioides, J. Ag. J. Ag., S. G. et O. Alg., III, 510.
J. Ag., Flor. Morph., XXVIII, 1–5.

NEMALION.

N. insigne, Harv. J. Ag., S. G. et O. Alg., III, 508.
Harv., Phyc. Aus., V, pl. 284.

* TIAROPHORA.

* T. australis, J. Ag. J. Ag., Genus novum et species nova, 1887.
J. Ag., Alg. Syst., VI, p. 45.

HELMINTHORA.

H. divaricata, J. Ag. Kütz., Sp. Alg., 713. Sub nomine Nemalion divaricatum.
J. Ag., S. G. et O. Alg., III, 507.
J. Ag., Flor. Morph., XXVIII, 6–11.

HELMINTHOCLADIA.

H. australis, Harv. J. Ag., S. G. et O. Alg., III, 506.
J. Ag., Alg. Syst., VI, p. 39.
Harv., Phyc. Aus., V, pl. 272.

Ordo IX. DELESSERIEÆ.

DELESSERIA.

D. frondosa, Harv. Kütz., Sp. Alg., 876. Sub nomine Hypoglossum frondosum. J. Ag., S. G. et O. Alg., III, 485.
J. Ag., Flor. Morph., XXVI, 18–19.
Harv., Phyc. Aus., III, pl. 179.

* D. heterocystidea, J. Ag. Species nova, 1885.
J. Ag., Alg. Syst., IV, p. 71.

D. imbricata, Aresch. J. Ag., S. G. et O. Alg., III, 494.
Harv., Phyc. Aus., IV, pl. 240. Sub nomine Chauvinia imbricata.

* D. marginifera, J. Ag. Species nova? A me lecta et ad J. G. Agardh, missa anno 1890. Sub numero 55. Descriptionem hucusque invenire nequeo.

D. revoluta, Harv. J. Ag., S. G. et O. Alg., III, 490.
Harv., Phyc. Aus., III, pl. 170.

D. simulans, J. Ag. Kütz., Sp. Alg., 876. Sub nomine Hypoglossum lyallii.
J. Ag., S. G. et O. Alg., III, 488.

NITOPHYLLUM.

N. affine, Harv. Kütz., Sp. Alg., 869. Sub nomine Aglaophyllum affine. J. Ag., S. G. et O. Alg., III, 456.

N. crispum, Kütz. Kütz., Sp. Alg., 868.
J. Ag., S. G. et O. Alg., III, 448.

N. endiviæ-folium, Hook. et Harv. Alg. Tasm., p. 6.
J. Ag., S. G. et O. Alg., III, p. 461.

N. erosum, Harv. J. Ag., S. G. et O. Alg., III, 460.
Harv., Phyc. Aus., II, pl. 94.

* N. fallax, J. Ag. Ms., species nova, 1887.

N. gattyanum, J. Ag. J. Ag., S. G. et O. Alg., III, 454.

N. gunnianum, Harv. Kütz., Sp. Alg., 868.
J. Ag., S. G. et O. Alg., III, 456.
J. Ag., Flor. Morph., XXVII, 13.
Harv., Phyc. Aus., V, pl. 241.

N. multipartitum, Hook. et Harv. Kütz., Sp. Alg., 868.
J. Ag., S. G. et O. Alg., III, 457.

N. obscurum, J. Ag. J. Ag., S. G. et O. Alg., III, 452.

N. parvifolium, Ag. J. Ag., S. G. et O. Alg., III, 457.

N. polyanthum, J. Ag. J. Ag., S. G. et O. Alg., III, 461.
N. pristoideum, Harv. J. Ag., S. G. et O. Alg., III, 460.
Harv., Phyc. Aus., IV, pl. 229.
N. pulchellum, Harv. J. Ag., S. G. et O. Alg., III, 447.
* N. subfulvum, J. Ag. Ms., species nova, 1889.
N. uncinatum, J. Ag. Kütz., Sp. Alg., 870. Sub nomine Cryptopleura lacerata. J. Ag., S. G. et O. Alg., III, 465.

Ordo X. SPHÆROCOCCOIDEÆ.

STENOCLADIA.

S. furcata, J. Ag. J. Ag., S. G. et O. Alg., III, 439.
Harv., Phyc. Aus., IV, pl. 215.

HERINGIA.

* H. ceramioides, J. Ag. Ms., species nova, 1888.

DICRANEMA.

D. filiforme, Sond. Kütz., Sp. Alg., 757. Sub nomine Cystoclonium filiforme. J. Ag., S. G. et O. Alg., III, 436.
D. grevillei, Sond. J. Ag., S. G. et O. Alg., III, 435.
Harv., Phyc. Aus., II, pl. 120.
J. Ag., Flor. Morph., XXVI, 4-5.
* D. ramulifera, J. Ag. Ms., species nova, 1891.

SARCODIA.

S. montagneana, Kütz. Sp. Alg., 787. Sub nomine Rhodophyllis montagneana.
J. Ag., S. G. et O. Alg., III, 431.
S. novæ-hollandiæ, J. Ag. Ms.? Descriptionem nusquam invenio; planta a me ad J. G. Agardh relata, sub æstate 1887, sic ab illo determinata.
S. palmata, Sond. Alg., Nov. Holl. trop., p. 22.

TYLOTUS.

T. obtusatus, J. Ag. Kütz., Sp. Alg., 784. Sub nomine Sphærococcus obtusatus. J. Ag., S. G. et O. Alg., III, 429. Harv., Phyc. Aus., IV, pl. 210.
J. Ag., Flor. Morph., XXIV, 7-8.

GRACILARIA.

G. confervoides, Grev. Kütz., Sp. Alg., 772. Sub nomine Sphærococcus confervoides.
J. Ag., S. G. et O. Alg., III, 413.

G. fruticosa, Harv. J. Ag., S. G. et O. Alg., III, 416.
Harv., Syn. Cat., 427.

G. furcellata, Harv. J. Ag., S. G. et O. Alg., III, 419.
Harv., Phyc. Aus., IV, pl. 286.

MELANTHALIA.

M. obtusata, Mont. J. Ag., S. G. et O. Alg., III, 404.
Harv., Phyc. Aus., I, pl. 25.

CURDIÆA.

C. laciniata, Harv. J. Ag., S. G. et O. Alg., III, 402.
Harv., Phyc. Aus., I, pl. 39.

PHACELOCARPUS.

P. labillardierii, J. Ag. J. Ag., S. G. et O. Alg., III, 399.
Harv., Phyc. Aus., III, pl. 163.

NIZYMENIA.

N. australis, Sond. J. Ag., S. G. et O. Alg., III, 397.
Harv., Phyc. Aus., III, pl. 165.

Ordo XI. CORALLINEÆ.

CORALLINA.

C. officinalis, Lamour. Kütz., Sp. Alg., 708. Sub nomine C. palmata. J. Ag., S. G. et O. Alg., II, 562.

C. cuvieri, Lamour. Kütz., Sp. Alg., 708.
J. Ag., S. G. et O. Alg., II, 572.

C. nana, Zan. Kütz., Sp. Alg., 709. J. Ag., S. G. et O. Alg., II, 564.

C. pilifera, Lamour. Kütz., Sp. Alg., 708. J. Ag., S. G. et O. Alg., II, 571.

JANIA.

J. fastigiata, Harv. J. Ag., S. G. et O. Alg., II, 556.
Harv., Phyc. Aus., V, pl. 251

J. micrarthrodia, Lamour. J. Ag., S. G. et O. Alg., II, 555.

ARTHROCARDIA.

A. wardii, Harv. J. Ag., S. G. et O. Alg., II, 551.

AMPHIROA.

A. australis, Sond. Kütz., Sp. Alg., 703.
J. Ag., S. G. et O. Alg., II, 537.
Harv., Phyc. Aus., II, pl. 77.
A. charoides, Lamour. Kütz., Sp. Alg., 702.
J. Ag., S. G. et O. Alg., II, 539.
A. stelligera, Lamour. Kütz., Sp. Alg., 701.
J. Ag., S. G. et O. Alg., II, 540.
Harv., Phyc. Aus., IV, pl. 230.

MASTOPHORA.

M. lamourouxii, Decaisne. J. Ag., S. G. et O. Alg., II, 526.

LITHOTHAMNION.

L. mamillare, Harv. J. Ag., S. G. et O. Alg., II, 521.

MELOBESIA.

M. patena, Hook. et Harv. Kütz., Sp. Alg., 696. Sub nomine Mastophora crassiuscula. J. Ag., S. G. et O. Alg., II, 514.

Ordo XII. SQUAMARIEÆ.

PEYSSONELIA.

P. australis, Sond. Harv., Phyc. Aus., II, pl. 81.

Ordo XIII. RHODYMENIACEÆ.

RHODOPHYLLIS.

R. goodwiniæ, J. Ag. J. Ag., S. G. et O. Alg., III, 367.
J. Ag., Flor. Morph., XXII, 1–7.
R. gunnii, Harv. J. Ag., S. G. et O. Alg., III, 366.
R. pulchella, J. Ag. Ms., speciei diagnosin nusquam video; specimina ad J. G. Agardh missa sub numeris 70, anno 1888, et 98, anno 1884.
R. ramentacea, Ag. J. Ag., S. G. et O. Alg., III, 365.
R. volans, Harv. J. Ag., S. G. et O. Alg., III, 363.
Harv., Phyc. Aus., IV, pl. 216.

PLOCAMIUM.

P. angustum, J. Ag. J. Ag., S. G. et O. Alg., II, 402, III, 343.
P. coccineum, Lamour. Kütz., Sp. Alg., 883.
J. Ag., S. G. et O. Alg., II, 395, III, 339.
P. costatum, J. Ag. Kütz., Sp. Alg., 886.
J. Ag., S. G. et O. Alg., II, 403, III, 344.
P. cystophyllum, J. Ag. J. Ag., S. G. et O. Alg., III, 339. Sub nom. P. coccinium, var. uncinatum.
P. leptophyllum, Kütz. Sp. Alg., 885.
J. Ag., S. G. et O. Alg., III, 338.
P. mertensii, Harv. J. Ag., S. G. et O. Alg., III, 346.
P. nidificum, Harv. J. Ag., S. G. et O. Alg., III, 346.
P. preissianum. Sond. Kütz., Sp. Alg., 885.
J. Ag., S. G. et O. Alg., III, 342.
Harv., Phyc. Aus., II, pl. 63.
P. procerum, J. Ag. Kütz., Sp. Alg., 886.
J. Ag., S. G. et O. Alg., III, 347.
Harv., Phyc. Aus., IV, pl. 223.

EPYMENIA.

E. angustata, Sond. Harv., Syn. Cat., 582.
E. halymenoides, J. Ag. J. Ag., Epicr., p. 694.
E. membranacea, Harv. J. Ag., S. G. et O. Alg., 334.
Harv., Phyc. Aus., II, pl. 89.

RHODYMENIA.

R. corallina, Auch. Kütz., Sp. Alg., 780. Sub nomine Sphærococcus corallinus. J. Ag., S. G. et O. Alg., III, 330.
R. foliifera, Harv. J. Ag., S. G. et O. Alg., III, 331.
Harv., Syn. Cat., 508.
R. leptophylla, J. Ag. Hujus speciei descriptionem non vidi.
R. linearis, J. Ag. J. Ag., S. G. et O. Alg., III, 331.
* R. stenoglossa, J. Ag. Species nova, 1887.
J. Ag., Alg. Syst., IV, p. 50.

* AMPHIBRACHIA.

* A. hymenocladioides, J. Ag. Ms., novum genus et species nova, 1891.

CORDYLECLADIA.

C. australis, J. Ag. Diagnosin nusquam invenio.
C. furcellata, J. Ag. J. Ag., S. G. et O. Alg., III, 327.

GLOIOPHYLLIS.

G. barkeriæ, J. Ag. = Rhodophyllis barkeriæ, Harv.
J. Ag., Alg. Syst., VI, p. 29.
Harv., Phyc. Aus., V, pl. 276.
G. barkeriæ, var. palmata, J. Ag.
J. Ag., Alg. Syst., VI, p. 30.

CHRYSYMENIA.

* C. gelatinosa, J. Ag. Species nova, 1889.
J. Ag., Alg. Syst., VI, p. 24.
C. obovata, Sond. Kütz., Sp. Alg., 865. Sub nomine Gastroclonium obovatum.
J. Ag., S. G. et O. Alg., III, 324.
Harv., Phyc. Aus., I, pl. 10.
* C. polyglotta, J. Ag. Ms., species nova, 1886.

GLOIOSACCION.

G. brownii, Harv. Kütz., Sp. Alg., 719. Sub nomine Dumontia ovalis.
J. Ag., S. G. et O. Alg., III, 317.
Harv., Phyc. Aus., II, pl. 83.
G. hydrophora, Harv. Diagnosis deest. Forsitan Kütz., Sp. Alg., 719. Dumontia hydrophora.

HYMENOCLADIA.

H. conspersa, J. Ag. = Chrysymenia meredithiana.
J. Ag., S. G. et O. Alg., III, 315.
Harv., Phyc. Aus., IV, pl. 237. Sub nomine Calliblepharis conspersa.
H. gracilarioides, J. Ag. J. Ag., S. G. et O. Alg., III, 313.
Harv., Phyc. Aus., V, pl. 260. Sub nomine Gracilana ramalina.
H. linearis, Sond. Sond., Bot. Zeit. Diagnosin non vidi.
H. polymorpha, Harv. J. Ag., S. G. et O. Alg., III, 315.
Harv., Phyc. Aus., III, pl. 157. Sub nomine Rhodymenia polymorpha.
H. usnea, J. Ag. J. Ag., S. G. et O. Alg., III, 313.
Harv., Phyc. Aus., II, pl. 118.

Ordo XIV. CHAMPIEÆ.

CHAMPIA.

C. affinis, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 304.
C. parvula, Harv. J. Ag., S. G. et O. Alg., III, 303.
C. tasmanica, Harv. Kütz., Sp. Alg., 861.
J. Ag., S. G. et O. Alg., III, 306.
J. Ag., Flor. Morph., XIX, 10–12.

CHYLOCLADIA.

C. clavellosa, Grev. Kütz., Sp. Alg., 859. Sub nomine Chondrothamnion clavellosum.
J. Ag., S. G. et O. Alg., III, 297.
* C. corynephora, J. Ag. Species nova, 1885.
J. Ag., Alg. Syst., VI, p. 23.
* C. foliifera, J. Ag. Species nova, 1886. Nondum descripta.
* C. monochlamydea, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., VI., p. 22.
C. muelleri, Sond. J. Ag., S. G. et O. Alg. III, 302.
Harv., Phyc. Aus., III, pl. 138.

FAUCHEA.

F. coronata, J. Ag. J. Ag., S. G. et O. Alg., III, 294.
Harv., Phyc. Aus., II, pl. 97.
J. Ag., Flor. Morph., XIX, 5–7.

HOREA.

H. fruticulosa, Harv. J. Ag., S. G. et O. Alg., III, 292.
Harv., Phyc. Aus., III, pl. 156.
H. halymenoides, Harv. J. Ag., S. G. et O. Alg., III, 292.
Harv., Phyc. Aus., II, pl. 67.
J. Ag., Flor. Morph., XIX, 1–4.
H. polycarpa, Harv. J. Ag., S. G. et O. Alg., III, 293.
H. speciosa, Harv. J. Ag., S. G. et O. Alg., III, 292.
* H. wilsonis, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., IV, p. 38.

Ordo XV. ARESCHOUGIEÆ.

THYSANOCLADIA.

T. laxa, Sond. J. Ag., S. G. et O. Alg., 288.
Harv., Phyc. Aus., IV, pl. 211.

ARESCHOUGIA.

A. conferta, Harv. Harv., Phyc. Aus., III, pl. 166.
J. Ag., S. G. et O. Alg., III, 440. Sub nomine Stenocladia harveyana.
A. congesta, J. Ag. J. Ag., S. G. et O. Alg., III, 281.
A. intermedia, J. Ag. Diagnosis me diligenter conquirentem præteriit.
A. laurencia, Hook. et Harv. J. Ag., S. G. et O. Alg., 282.
A. stuartii, Harv. J. Ag., S. G. et O. Alg., 282.
Harv., Phyc. Aus., V, pl. 294.

ERYTHROCLONIUM.

E. angustatum, Sond. J. Ag., S. G. et O. Alg., III, 278.
E. muelleri, Sond. J. Ag., S. G. et O. Alg., III, 278.
Harv., Phyc. Aus., V, pl. 298.

Ordo XVI. SPYRIDIEÆ.

SPYRIDIA.

S. biannulata, J. Ag. J. Ag., S. G. et O. Alg., III, 267.
S. filamentosa, Harv. Kütz., Sp. Alg., 665.
J. Ag., S. G. et O. Alg., III, 268.
J. Ag., Flor. Morph., XVI, 11–17.
S. opposita, Harv. J. Ag., S. G. et O. Alg., III, 270.
Harv., Phyc. Aus., III, pl. 158.

Ordo XVII. DUMONTIACEÆ.

NIZZOPHLÆA.

N. tasmanica, J. Ag. J. Ag., S. G. et O. Alg., III, 256.
Harv., Phyc. Aus., II, pl. 115.
J. Ag., Flor. Morph., XVII, 11–13.

Ordo XVIII. DUDRESNAYEÆ.

DUDRESNAYA.

* D. australis, J. Ag. Ms., species nova, 1887.

Ordo XIX GIGARTINEÆ.

CALLOPHYLLIS.

* C. alternifida, J. Ag. Ms., species nova, 1887.
C. carnea, J. Ag. J. Ag., Alg. Syst., IV, p. 37.

C. coccinea, Hook. et Harv. Kütz., Sp. Alg., 746.
J. Ag., S. G. et O. Alg., III, 234.
C. harveyana, J. Ag. J. Ag., S. G. et O. Alg., III, 230.
Harv., Phyc. Aus., IV, pl. 193. Sub nomine
C. obtusifolia.
C. lamberti, Hook. et Harv. J. Ag., S. G. et O. Alg. III, 233.
* C. patens, J. Ag. Ms., species nova, 1891.
* C. wilsoniana, J. Ag. Species nova, 1886. An forma
Callophyllidis harveyanæ.

POLYCŒLIA.

P. laciniata, J. Ag. J. Ag., S. G. et O. Alg., III, 228.

EPIPHLÆA.

* E. grandifolia, J. Ag. Species nova, 1889.
J. Ag., Alg. Syst., VI, p. 20.

* GLAPHYRYMENIA.

* G. pustulosa, J. Ag. Genus novum et species nova
1884.
J. Ag., Alg. Syst., IV, p. 53.

KALLYMENIA.

K. cribrosa, Harv. J. Ag., S. G. et O. Alg., III, 219.
Harv., Phyc. Aus., II, pl. 73.
K. tasmanica, Harv. J. Ag., Alg. Syst., VI, p. 17.

* MEREDITHIA.

M. polycœlioides, J. Ag. J. Ag., S. G. et O. Alg., III,
687. Sub nomine Kallymenia poly-
cœlioides.
* M. nana, J. Ag. Ms., species nova, 1889.

STENOGRAMMA.

S. interruptum, Mont. Kütz., Sp. Alg., 873.
J. Ag., S. G. et O. Alg., III, 215.
Harv., Phyc. Aus., IV, pl. 220.
* S. leptophyllum, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., VI, p. 32.

GIGARTINA.

G. binderi, Harv. Kütz., Sp. Alg., 740. Sub nomine
Chrondroclonium lividum.
J. Ag., S. G. et O. Alg., III, 191.
Harv., Syn. Cat., No. 565.

G. gigantea, J. Ag. J. Ag., Alg. Syst., IV, p. 31.
* G. lanecata, J. Ag. Ms., species nova, 1889.
G. livida, J. Ag. J. Ag., S. G. et O. Alg., III, 196. Harv., Phyc. Aus., II, pl. 68. Sub nomine G. pinnata.
G. pinnata, J. Ag. J. Ag., S. G. et O. Alg., III, 196.
G. wehliæ, Sond. J. Ag., S. G. et O. Alg., III, 198.

RHODOGLOSSUM.

R. foliiferum, J. Ag. J. Ag., S. G. et O. Alg., III, 186. J. Ag., Flor. Morph., XI, 4–8.
R. lanceolatum, J. Ag. J. Ag., S. G. et O. Alg., III, 186. Harv., Phyc. Aus., V, pl. 288. Sub. nomine Gigartina lanceolata. J. Ag., Alg. Syst., IV, p. 26.
R. polycarpum, J. Ag. J. Ag., S. G. et O. Alg., III, 186. J. Ag., Flor. Morph., XI, 1–3.

IRIDÆA.

* I. australasica, J. Ag. Ms., species nondum descripta, 1891.

Ordo XX. CRYPTONEMIACEÆ.

THAMNOCLONIUM.

T. codioides, J. Ag. J. Ag., S. G. et O. Alg., III, 168.

* HORMOPHORA.

* H. australasica, J. Ag. Novum genus et species nova, 1886. Descriptio nondum in tabulas relata.

CRYPTONEMIA.

* C. inequalis, J. Ag. Ms., species nova, 1886. Nondum descripta.
* C. tenuis, J. Ag. Ms., species nova, 1891. Nondum descripta.
* C. wilsoni, J. Ag. Species nova, 1885. J. Ag., Alg. Syst., IV, p. 25.
* C. wilsoni var. major, an species nova. J. Ag., 1887.

GELINARIA.

G. harveyana, J. Ag. J. Ag., Alg. Syst., VI, p. 11.

GRATELOUPIA.

* G. australis, J. Ag. Ms., species nova, 1886.

POLYOPES.

P. constrictus, J. Ag. J. Ag., S. G. et O. Alg., III, 148.
J. Ag., Flor. Morph., VI, 1–4.

PACHYMENIA.

* P. sessilis, J. Ag. Species nova, sic in albo anni 1891, a J. G. Ag. nominata, (an eadem quæ in Till Algernes Systematik descripta est, VI, p. 11. Sub nomine P. apoda ?)

HALYMENIA.

H. digitata, J. Ag. Ms., nondum descripta. A me lecta, 1887.
H. harveyana, J. Ag. = H. floresia, Harv.
Harv., Phyc. Aus., IV, pl. 214.
H. kallymenoides, J. Ag. J. Ag., Alg. Syst., VI,, p. 8.

NEMASTOMA.

* N. caulescens, J. Ag. Ms., species nova, 1891. Nondum descripta.
N. feredayæ, Harv. J. Ag., S. G. et O. Alg., III, 126.

Ordo XXI. CERAMIEÆ.

CENTROCERAS.

C. clavulatum, Ag. Kütz., Sp. Alg., 689. Sub nomine Centroceras leptacanthum. J. Ag., S. G. et O. Alg., III, 108.

CERAMIUM.

C. apiculatum, J. Ag. J. Ag., S. G. et O. Alg., III, 105.
C. diaphanum, J. Ag. Kütz., Sp. Alg., 675.
J. Ag., S. G. et O. Alg., III, 98.
C. fastigiatum, Harv. Kütz., Sp. Alg., 678.
J. Ag., S. G. et O. Alg., III, 96.
C. gracillimum, Harv. J. Ag., S. G. et O. Alg., III, 95.
C. isogonum, Harv. J. Ag., S. G. et O. Alg., III, 96.
Harv., Phyc. Aus., IV, pl. 206 B.

C. miniatum, Suhr. J. Ag., S. G. et O. Alg., III, 104.
Harv., Phyc. Aus., IV, pl. 206 A.
C. nodiferum, J. Ag. J. Ag., S. G. et O. Alg., III, 99.
C. puberulum, Sond. J. Ag., S. G. et O. Alg., III, 102.
C. ramulosum, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 95.
C. rubrum, Ag. J. Ag., S. G. et O. Alg., III, p. 100.
J. Ag., Flor. Morph., III, 21–23.

HALOPLEGMA.

H. preissii, Sond. Kütz., Sp. Alg., 672.
J. Ag., S. G. et O. Alg., III, 90.
Harv., Phyc., Aus., II, pl. 79.

PTILOCLADIA.

P. pulchra, Harv. Kütz., Sp. Alg., 674.
J. Ag., S. G. et O. Alg., III, 89.
Harv., Phyc. Aus., IV, pl. 209.

DASYPHILA.

D. preissii, Sond. Kütz., Sp. Alg., 673.
J. Ag., S. G. et O. Alg., III, 88.
Harv., Phyc. Aus., II, 66.

CROUANIA.

C. agardhiania, Harv. J. Ag., S. G. et O. Alg., III, 87.
Harv., Phyc. Aus., V, pl. 256.
C. australis, J. Ag. J. Ag., S. G. et O. Alg., III, 85.
C. insignis, Harv. J. Ag., S. G. et O. Alg., III, 87.
C. muelleri, Harv. Harv., Syn. Cat., No. 638.

THAMNOCARPUS.

* T. glomuliferus, J. Ag. Species nova, 1886.
J. Ag., Alg. Syst., IV, p. 6.

PTILOTA.

P. articulata, J. Ag. J. Ag., S. G. et O. Alg., III, 78.
P. rhodocallis, Harv. Kütz., Sp. Alg., 670. Sub nomine Rhodocallis elegans. J. Ag., S. G. et O. Alg., III, 79. Harv., Phyc. Aus., I, pl. 44.
P. siliculosa, Harv. J. Ag., S. G. et O. Alg., III, 79.
Harv., Syn. Cat., No. 646.

GRIFFITHSIA.

G. antarctica, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 68.
* G. corticata, J. Ag. Ms., species nova, 1890. Nondum descripta.
G. elongata, J. Ag. J. Ag., S. G. et O. Alg., III, 62.
G. gunniana, J. Ag. J. Ag., S. G. et O. Alg., III, 68.
G. licmophora, J. Ag. J. Ag., S. G. et O. Alg., III, 63. Harv., Phyc. Aus., II, pl. 90. Sub nomine Callithamnion licmophorum.
G. monile, Harv. J. Ag., S. G. et O. Alg., III, 65.
G. sonderiana, J. Ag. J. Ag., S. G. et O. Alg., III, 62. Harv., Phyc. Aus., III, pl. 160. Sub nomine Callithamnion griffithsioides.
G. tasmanica, J. Ag. J. Ag., S. G. et O. Alg., III, 64. J. Ag., Flor. Morph., I, 14.
G. teges, Harv. J. Ag., S. G. et O. Alg., III, 70. J. Ag., Alg. Syst., IV, p. 5.

BALLIA.

B. callitricha, Ag. Kütz., Sp. Alg., 663. J. Ag., S. G. et O. Alg., III, 57. J. Ag., Flor. Morph., III, 1–11.
B. mariana, Harv. J. Ag., S. G. et O. Alg., III, 58. Harv., Phyc. Aus., IV, pl. 212.
B. robertiana, Harv. J. Ag., S. G. et O. Alg., III, 58. Harv., Phyc. Aus., I, pl. 36.
B. scoparia, Harv. J. Ag., S. G. et O. Alg., III, 59. Harv., Phyc. Aus., III, pl. 168.

CALLITHAMNION.

C. angustatum, Harv. J. Ag., S. G. et O. Alg., III, 46.
C. brownianum, Harv. J. Ag., S. G. et O. Alg., III, 49. Harv., Syn. Cat., No. 667.
C. comosum, Harv. J. Ag., S. G. et O. Alg., III, 19.
C. conspicuum, Sond. J. Ag., S. G. et O. Alg., III, 45.
* C. crinale, J. Ag. Ms., species nova, 1889. Nondum descripta.
C. dasyurum, Harv. Harv., Syn. Cat., No. 664.
C. dispar, Harv. J. Ag., S. G. et O. Alg., III, 27. Harv., Phyc. Aus., IV, pl. 227.
C. divergens, J. Ag. J. Ag., S. G. et O. Alg., III, 19.

C. formosum, Harv. J. Ag., S. G. et O. Alg., III, 48.
Harv., Phyc. Aus., V, pl. 281.
C. gracilentum, Harv. J. Ag., S. G. et O. Alg., III, 21.
Harv., Syn. Cat., No. 701.
C. hanovioides, Sond. J. Ag., S. G. et O. Alg., III, 26.
C. laricinum, Harv. J. Ag., S. G. et O. Alg., III, 42.
Harv., Phyc., Aus., IV, pl. 218.
C. latissimum, Hook. et Harv. J. Ag., S. G. et O. Alg., III, 47.
C. mucronatum, J. Ag. J. Ag., S. G. et O. Alg., III, 19.
C. muelleri, Sond. J. Ag., S. G. et O. Alg., III, 27.
C. plumigerum, Harv. J. Ag., S. G. et O. Alg., III, 49.
Harv., Phyc. Aus., V, pl. 285.
C. plumula, J. Ag. J. Ag., S. G. et O. Alg., III, 24.
C. polyrhizum, Harv. J. Ag., S. G. et O. Alg., III, 12.
Harv., Syn. Cat., No. 712.
* C. tetracladum, J. Ag. Ms., species nova, 1890. Nondum descripta. Prope C. muelleri.
C. verticale, Harv. J. Ag., S. G. et O. Alg., III, 26.
* C. wilsonianum, J. Ag. Ms., species nova, 1883. Nondum descripta. (Inter C. wollastonianum et C. brownianum.)

CHLOROSPERMEÆ.

Ordo I. SIPHONACEÆ.

BRYOPSIS.

* B. baculifera, J. Ag. Species nova, 1880.
J. Ag., Alg. Syst., V, p. 21.
* B. clavæformis, J. Ag. Species nova, 1885.
J. Ag., Alg. Syst., V, p. 20.
* B. gemellipora, J. Ag. Species nova, 1884.
J. Ag., Alg. Syst., V, p. 25.
B. plumosa, J. Ag. Alg. Syst, V, p. 24.

CODIUM.

C. bursa, Grev. J. Ag., Alg. Syst., V, p. 38.
C. elongatum, J. Ag. Alg. Syst., V, p. 46.
C. galeatum, J. Ag. Alg. Syst., V, p. 42.
C. mucronatum, J. Ag. Alg. Syst., V, p. 43.

C. muelleri, Kütz. J. Ag., Alg. Syst., V, p. 42.
* C. pomoides, J. Ag. Ms., species nova, 1890. Nondum descripta.
C. spongiosum, Harv. J. Ag., Alg. Syst., V., p. 38. Harv., Phyc. Aus., I., pl. 55.
C. tomentosum, J. Ag. J. Ag., Alg. Syst., V, p. 40.

AVRAINVILLEA.

A. obscura, J. Ag. J. Ag., Alg. Syst., V, p. 53.

* CALLIPSYGMA.

* C. wilsonis, J. Ag. Novum genus et species nova, 1882. J. Ag., Alg. Syst., V, p. 67.

UDOTEA.

* U. peltata, J. Ag. Species nova, 1885. J. Ag., Alg. Syst., V, p. 74.

APJOHNIA.

A. lætevirens, Harv. J. Ag., Alg. Syst., V, p. 108. Harv., Phyc. Aus., I, pl. 5.

DICTYOSPHÆRIA.

D. sericea, Harv. J. Ag., Alg. Syst., V, p. 118.

CAULERPA.

C. abies-marina, J. Ag. J. Ag., Alg. Syst., I, p. 18.
* C. alternifolia, J. Ag. Species nova, 1886. J. Ag., Alg. Syst., V, p. 129.
C. cactoides, J. Ag. J. Ag., Alg. Syst., I, p. 44. Harv., Phyc. Aus., I, pl. 26.
* C. curvifolia, J. Ag. Ms., species nova, 1884. Nondum descripta.
C. harveyi, F. v. Mueller. J. Ag., Alg. Syst., I, p. 17. Harv., Phyc. Aus., II, pl. 95.
C. hypnoides, R. Br. J. Ag., Alg. Syst., I, p. 33. Harv., Phyc. Aus., II, pl. 84.

C. muelleri, Sonder. J. Ag., Alg. Syst., I, p. 34.
Harv., Phyc. Aus., I, pl. 2.
C. papillosa, J. Ag. J. Ag., Alg. Syst., I, p. 42.
C. scalpelliformis, J. Ag. J. Ag., Alg. Syst., I, p. 12.
Harv., Phyc. Aus., I, pl. 17.
C. sedoides, J. Ag. J. Ag., Alg. Syst, I, p. 39.
Harv., Phyc. Aus., II, pl. 72.
C. simpliciuscula, J. Ag. J. Ag., Alg. Syst., I, p. 41.
Harv., Phyc. Aus., II, pl. 65, figs. 1–2.
C. sonderi, F. v. Mueller. J. Ag., Alg. Syst., I, p. 18.
Harv., Phyc. Aus., III, pl. 167.
C. trifaria, Harv. J. Ag., Alg. Syst., I, p. 16.
Harv., Phyc. Aus., V, pl. 261.
C. vesiculifera, Harv. J. Ag., Alg. Syst., I, p. 40.
Harv., Phyc. Aus., II, pl. 65, fig. 3.

POLYPHYSA.

P. peniculus, Lamour. Kütz., Sp. Alg., 510. Sub nomine Polyphysa aspergillosa.
J. Ag., Alg. Syst., V, p. 161.
Harv., Phyc. Aus., I, pl. 11.

Ordo II. ULVACEÆ.

PORPHYRA.

P. vulgaris, J. Ag. Kütz., Sp. Alg., 692.

ULVA.

U. latissima, J. Ag. Kütz., Sp. Alg., 477. Sub nomine Phycoseris australis.
J. Ag., Alg., Syst., III, p. 164.
U. lætevirens, Areschoug. J. Ag., Alg. Syst., III, p. 167.

ENTEROMORPHA.

E. bulbosa, Lu. J. Ag., Alg. Syst., III, p. 139.
E. clathrata, Kütz. J. Ag., Alg. Syst., III, p. 153.
E. flexuosa, Walf. J. Ag., Alg. Syst., III, p. 126.
E. hopkirkii, Harv. J. Ag., Alg. Syst., III, p. 151.
E. lingulata, J. Ag. J. Ag., Alg. Syst., III, p. 143.
E. opposita, J. Ag. Descriptionem nusquam invenio.

Ordo III. CONFERVACEÆ.

CLADOPHORA.

C. acrosiphonia, J. Ag. Descriptio mihi hactenus ignota.
C. feredayi, Harv. Harv., Phyc. Aus., I, pl. 47.
C. gracilis, Griff. Harv., Syn. Cat., No. 770.

CHÆTOMORPHA.

C. valida, Harv. Kütz., Sp. Alg., 379.

CONFERVA.

C. arenosa, Carm. Kütz., Sp. Alg., 384.
C. valida, J. Ag. Kütz., Sp. Alg., 379.

Ordo IV. OSCILLARIACEÆ.

RIVULARIA.

R. nitida, Harv. Kütz., Sp. Alg., 332.

MEETINGS OF THE ROYAL SOCIETY.

1891.

[N.B.—The remarks and speeches in the discussions are taken down verbatim by a shorthand writer, and afterwards written out at length with a typewriter, for reference and reproduction, if required; and therefore, more is seldom given herein than an indication of their general drift. If any person should wish to refer to the verbatim report, he can apply to the Secretary to the Society, who will give him an opportunity of perusing and copying it, or if he resides at a distance, so much as he requires will, upon payment of the cost of reproducing it, be forwarded to his address.]

ANNUAL MEETING.

Thursday, March 12th.

The President (Professor KERNOT) in the chair.

ANNUAL REPORT.

The Council of the Royal Society herewith presents to the Members of the Society the usual Annual Report for the year 1890. The following meetings were held and papers read during the Session:—

On the 13th March, at the Ordinary Meeting held after the Annual General Meeting, Mr. A. J. Campbell "On the Oology of Western Australia."

On the 8th May, Mr. A. H. S. Lucas, "On Fishes New to Victoria;" Professor Spencer, on "The Nomenclature of Chicken Embryos for Teaching Purposes;" Mr. Arthur Dendy, "On the Victorian Land Planarians."

On the 12th June, Professor Orme Masson, a preliminary note on "The Physical Properties of Ethides considered in

reference to the Periodic Law of the Elements;" Mr. Arthur Dendy, "Note from the Biological Laboratory of the University of Melbourne on the Presence of Corpuscles Discharged from the Apertures of the Nephridia and Oral Papillæ of Peripatus;" Mr. D. McAlpine, (*a*) "Observations on the Movements of the Heart of Hoplocephalus superbus in and out of the body," (*b*) "Remarks on a Fluke Parasitic in the Body of Hoplocephalus superbus," and (*c*) "Observations on a Nematode found in the Stomach of Hoplocephalus superbus."

On the 10th July, Mr. A. W. Howitt, "On the Eucalypts of Gippsland."

On the 14th August, Mr. G. S. Griffiths, "On the Marine Sedimentary Strata Beds underlying Warrnambool;" Professor Orme Masson, "The Relations of Molecular Volumes and Boiling Points."

On the 11th September, Postscript by Professor Orme Masson to the last paper read by him; Professor Ralph Tate, "Note on Shell-bearing Mollusca obtained in the Port Phillip Biological Survey;" Rev. R. H. Rickard, "The New Britain Currency or Shell-money.

On the 9th October, Mr. J. Dennant, "Notes on the Pliocene Strata at Jemmy's Point, with Brief Remarks on the Older Tertiary at Bairnsdale;" Mr. G. Gordon McCrae, "Notes on the Coco-de-mer."

On the 13th November, Mr. P. H. MacGillivray, "Description of New and Little-known Polyzoa, Part XIV;" Rev. R. H. Rickard, "The Duk Duk Association of New Britain;" Professor Spencer, "Two Rare Hydroids from Port Phillip;" Mr. John Dennant, "Appendix to Remarks on the Older Tertiary Strata at Bairnsdale."

On the 11th December, Mr. Arthur Dendy, "Monograph of the Victorian Sponges. Part I. The Anatomy and Classification of the Calcarea Homocœla, with Descriptions of the Victorian Species;" Professor Spencer, "Notes on some Victorian Land Planarians;" Mr. T. S. Ralph, "Observations and Experiments on the Coloured Material of the Red Corpuscles."

The following Members and Associates were elected during the year:—Members—Mr. Ludovico Hart, Mr. Pietro Barracchi, Rev. John Mathew, Mr. Alexander Leeper, LL.D.,

Mr. J. W. Springthorpe, M.D., Mr. H. R. Hogg, Mr. J. Talbot Brett, M.R.C.S., Mr. Sidney Plowman, F.R.C.S., Mr. Lenthal Oldfield, Mr. G. A. Syme, M.B., F.R.C.S., Mr. C. G. W. Officer, Mr. C. N. Hake. Associates—Mr. W. H. A. Pye, Miss Lilian Mary Blair, Miss Louisa Florence Blair, Mr. J. S. Hart, M.A., B. Sc., Mr. Thomas Lambert, Mr. Henry T. Grayson, Mr. Robert Craig, Mr. R. T. Elliott, M.A., Mr. George Gordon McCrae, Mr. P. D. Phillips, Mr. Heinrich Best, Mr. Edward Emerson Rosenblum, M.B., Mr. C. N. Wilsmore, B. Sc., Mr. Elderson Smith, Mrs. Elderson Smith, Mr. Frank Goldstraw. Country Member—Mr. T. S. Hall, M.A.

Your Council regrets to have to record the loss by death of two old Members of the Society—Mr. Gaunt and Mr. Reed. To the latter, the Society owes a debt of gratitude for the generous way in which he had acted gratuitously as its architect from the time of its inception.

The Librarian reports the addition to the Library during the year of the following publications :—From England 210 parts, Scotland 20, Ireland 10, Germany 125, Austria 53, Switzerland 3, France 41, Italy 58, Spain and Portugal 12, Holland and Belgium 30, Denmark, Sweden and Norway 41, Russia and Roumania 24, India and Mauritius 57, China and Japan 5, Batavia 13, Canada 13, United States 99, Mexico and Guatemala 33, Argentine Republic and Chili 11, Victoria 127, New South Wales 34, South Australia 3, Queensland (principally Maps) 332, Tasmania 3, New Zealand 7, West Australia 1. Total publications received, 1365.

The additions to the Library during the year have been somewhat larger than usual. A few books have been purchased, but the bulk of the additions has consisted in Exchanges from other Societies. A good many volumes have been bound, and the Library generally has been rendered more available for reference by this means. It is not found, however, that Members use it very frequently for this purpose, although every reasonable facility is afforded to those who may desire to consult the really valuable works which it contains.

During the year, a gratifying increase has taken place in the membership of Section G (Literature and the Fine Arts), and in connection with this, very successful meetings have been held and good work accomplished. This is dealt with in the report of the Section.

During the course of the year, the Council acceded to the request of certain members and instituted Section E, to deal with Anthropological questions, and Mr. A. W. Howitt was appointed Chairman.

Your Council may fairly congratulate the Society upon a successful year, during which good work has been done. Naturally, the larger number of original contributions to science have dealt with the subjects of Zoology, Botany and Geology—subjects which are of especial importance in a country in which endless opportunities for original research are offered to workers in these particular branches of science. It may also be added, that the Society is offering every facility in its power to assist such workers in the publication of their results. During the year, the second part of the volume of "Transactions" has been published, together with the usual volume of "Proceedings," the increased annual grant from the Government enabling the Society to extend the scope of its publications, and in a manner which there is reason to say is not only received with favour in the Australasian Colonies, but also in the mother country.

Dr. *The Hon. Treasurer in Account with the Royal Society of Victoria to March 1, 1890.* Cr.

To Balance from 28th February, 1889		£192 14 10	By Printing and Stationery	£152 9 8
,, Government Grant—			,, Port Phillip Biological Survey	2 4 0
Balance of Vote for 1888-89	£150 0 0		,, Rates	4 15 0
First Instalment for 1889-90	50 0 0		,, Gas and Fuel	8 5 11
		200 0 0	,, Salary of Assistant Secretary	62 18 4
,, Entrance Fees		29 8 0	,, Shorthand Records	33 3 0
,, Subscriptions for 1889	260 8 0		,, Hall-keeper	9 6 0
,, ,, 1890	8 8 0		,, Collector's Commission	38 3 7
Arrears	37 16 0		,, Insurance	3 10 0
		306 12 0	,, Secretary's Postages	41 15 7
,, Rent of Rooms		17 0 0	,, Repairs and Furnishing	46 11 11
,, Sale of Transactions		0 17 0	,, Books and Periodicals	46 0 7
,, Interest		20 0 0	,, Freight	2 10 0
			,, Refreshments	3 4 6
			,, Treasurer's Postages and Petty Cash	3 14 5
			,, Balance, 28th February, 1890	307 19 4
		£766 11 10		£766 11 10

Compared with the Vouchers and Bank Pass-book and Cash-book, and found correct,

JAMES JAMIESON,
Hon. Treasurer.

28th February, 1890.

(Signed) H. MOORS, JAS. J. FENTON, } Auditors.

PUBLISHING AND RESEARCH FUND.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Fixed Deposit in Bank	£300	0	0	By Fixed Deposit in Bank of Australasia	£300	0	0
,, Interest on same	12	0	0	,, Interest transferred to General Account ..	12	0	0
	£312	0	0		£312	0	0

STATEMENT OF ASSETS AND LIABILITES.

ASSETS.	£	s.	d.	£	s.	d.	LIABILITIES.	£	s.	d.
To Entrance Fees (12)				£25	4	0	By Two Debentures	£10	0	0
,, Unpaid Subscriptions for 1890				394	16	0	,, ,, ,, (Interest Unclaimed	8	8	0
,, ,, ,, (arrears)				100	0	0	,, Estimated Unpaid Accounts	200	0	0
,, Rent of Rooms				20	0	0	,, Balance 28th February, 1890	6637	4	8
,, Hall, Library, and Furniture				5000	0	0				
,, Balance of Grant for 1889-90				375	0	0				
,, Two-thirds of Grant for 1890-91				332	13	4				
,, Publishing Fund	£300	0	0							
,, General Account Balance ..	307	19	4							
				607	19	4				
				£6855	12	8		£6855	12	8

The PRESIDENT, after reading the Balance Sheet, said that financially the Society was in a perfectly satisfactory condition. The expenditure was large, and if there was a continuance of the publication of the elaborate Transactions that had been brought out by the Society during the last two or three years, all the money that could be obtained either from the Government or from Members, in the shape of subscriptions, would be required. The Transactions lately issued were illustrated with diagrams, and were highly prized in other parts of the world. The work that was being done, in connection with local Biology, was bringing very great honour and credit to the Society amongst scientists in Europe and America, but that good work would need for its continuance all the funds that could be obtained.

On the motion of Dr. NEILD, seconded by Mr. GRIFFITHS, the Balance Sheet was adopted.

ANNUAL REPORT.

Mr. BLACKETT moved, and Mr. NEWTON JENNINGS seconded a resolution, "That the Annual Report, which had been printed and circulated amongst the Members, be taken as read and adopted." The resolution was carried.

The PRESIDENT said that he considered the Report to be a favourable and satisfactory one. The work done during the year was to a great extent biological, partly geological, and there had been a little chemical work. It was all good work, and was being published in the proper way, thus rendering the Transactions and Proceedings creditable to themselves and valuable to scientists elsewhere.

ELECTION OF OFFICE-BEARERS.

The PRESIDENT announced that, as the nominations of Office-bearers did not exceed in number the positions to be filled, it was his duty to declare the following gentlemen duly elected, on the motion of Mr. White, seconded by Professor Spencer:—President—Professor W. C. Kernot, M.A., C.E. Vice-Presidents—J. Cosmo Newbery, C.M.G., B.Sc., and E. J. White, F.R.A.S. Hon. Treasurer—C. R. Blackett, F.C.S. Hon. Librarian—J. E. Neild, M.D. Hon. Secretaries—H. K. Rusden and Professor W. Baldwin Spencer, M.A.

MEMBERS OF COUNCIL.

Members of Council—A. W. Howitt, J. Jamieson, M.D., A. H. S. Lucas, M.A., A. Sutherland, M.A., A. S. Way, M.A., and Professor Lyle, M.A.

For the two vacant seats on the Council, Mr. C. A. Topp and Professor Laurie were nominated, and elected.

The non-retiring Members of Council were:—R. L. J. Ellery, F.R.S., G. S. Griffiths, F.R.G.S., Professor Orme Masson, M.A., D.Sc., and H. Moors.

The Annual Meeting having been declared at an end by the President, an Ordinary Meeting was then held. The minutes of the last Ordinary Meeting were read and confirmed.

Mr. Alfred Reeve was elected as a Member.

Mr. John Desmond was nominated as a Country Member.

Mr. T. S. Hall, M.A., signed the Roll.

Dr. Neild, the Hon. Librarian, announced that the number of volumes and parts received this year was 221, and that one of the books received was an In Memoriam volume of the late Dr. H. C. Wigg, whose death all regretted very much. The volume was presented to the Society by the father of the deceased gentleman.

Mr. T. S. Hall, M.A., read a paper on "A New Species of Dictyonema."

Dr. Dendy read a paper on "A preliminary account of Synute pulchella, a New Genus and Species of calcareous sponge."

Replying to the President, Dr. Dendy said that the tissue both on the inner and the outer layer was undoubtedly protective against the inroads of parasites.

The President thought it was possible that the attacks of parasites for a great many ages might have led to the form referred to in the paper. He would like to know if the weaker forms were found in sheltered places.

Dr. Dendy said it was the general rule to find the weakest sponges in deep water, and in such places the sponges were more delicate than others. In shallow water they were stronger and more massive.

Mr. T. S. Hall, M.A., read a paper prepared by himself and Mr. G. B. Pritchard on "Notes on the Lower Tertiaries of the Southern portion of the Moorabool Valley."

The President said that the geology of this country was very far from being so thoroughly known as it might be, and such investigations as these would help to fill up the gaps.

Mr. G. S. Griffiths, F.G.S., said that the Society was indebted to the gentlemen who prepared the paper and the sections and plans accompanying it. A very intelligent and interesting account of the valley had been given in the paper,

proving that a very careful investigation of the strata thereabouts had been made. He was struck with the large amount of erosion that had occurred in the valley, which was evidently the bed of an old extension of Bass Straits. More knowledge was gradually being gained of the extension of this old arm of the sea, and it was quite evident from what was known, that a Strait once existed between the Otway Ranges and the Main Dividing Range. The Otway Ranges for many ages must have constituted an island in the Straits, about 70 miles long and perhaps 30 wide. There was a considerable amount of identity between the deposits all over the district. The limestone found there, specimens of which had been shown that evening, was very similar in its general character to that found so far away to the west as Portland. Beautiful white cliffs similar to those of Dover, and also lava, could be seen there. There is no doubt that the Strait was a very wide one, and the bores and shafts put down showed that there were narrow channels leading from the sea. Some miles to the west of Steiglitz mountainous country existed, and the river had cut its passage, not through the tertiary beds as described that evening, but through the immensely older Silurian. These ancient Silurian valleys that had been cut by the old Moorabool were immensely deeper than the valleys of the present day. They had been filled up gradually by the sedimentary beds in the same manner as the Strait itself in the course of ages was filled up. In the Moorabool Valley, in the neighbourhood to which he was referring, Pliocene lava was seen on the surface. Beneath that there was sand and gravel and the auriferous wash of the miner. Sinking still further through the shallow level strata, a bed of coralline limestone 13 feet thick was reached. That bed being organic, grew at the time when the whole country was considerably lower than it is to-day; when, in fact, the sea ran up the valley of the Moorabool and when the Moorabool itself was a little creek that had its sea mouth probably many miles further to the north of the section to which he was referring. Below the coralline limestone there was more sandstone, and below that again another layer of lava. It was not a solid bed of lava, as it consisted of a series of thin layers of basalt. Between those layers were sandwiched more layers of the coralline limestone. Between these beds, but lower down the stream, there were very thick beds 60 or 70 feet thick of what the miners term "cement"—sandstone containing quartz boulders. Then there was a false bottom carrying a lot of gold, and below that again there was another bed 30 or 40 feet thick of a different character. It seemed to him that the character of those two beds indicated the climate during the early tertiary period was very different to that of the present time. We

certainly had a pluvial period if we did not have a glacial period. Nothing but a pluvial period could account for the scouring off of the central ranges and the carrying down into the gullies and the wide river valleys of the very abundant deposits of boulder, gravel, and sand beds. The deposits are there now, and the size of the valleys proves that the stream of water that flowed off the central watershed was larger than the volume we have to-day. There was in the valley undoubted evidence of the existence in former time of a climate that was characterised by an enormous rainfall, one that was colder than that of the present day.

Mr. HALL agreed with Mr. Griffiths that there was considerable evidence of rainfall during the period in which the gravels were formed.

Thursday, April 9th.

The minutes of the preceding meeting were read and confirmed.

Mr. ALFRED REEVE signed the Roll, and was introduced to the meeting.

Mr. JOHN DESMOND was elected as a Country Member.

Dr. NEILD, the Hon. Librarian, stated that since the last meeting, 79 volumes had been received from various parts of the world. The binding of the periodicals was steadily progressing and it was his intention to ask the Council at their next meeting, to vote a little more money for this purpose.

It had been suggested to him that greater facilities should be afforded to Members desirous of taking books out of the Library. As it had been found very inconvenient to allow Members to take books from the Library at their option, a great many valuable periodicals having been lost through mere forgetfulness on the part of the Members to return them, the Council had resolved that it was expedient that their consent should be obtained when books were taken from the Library. This resolution had been extended, making the consent of only one Member of the Council necessary. He thought that Members would not suffer any hardship through this regulation, which was rendered necessary in view of the fact that many of the books of the Library were very valuable, and practically irreplaceable if lost.

The PRESIDENT agreed with Dr. Neild as to the importance of watching the Library very closely indeed. It was a Library of an unusual character, and likely to be extremely valuable to persons making researches in special branches of science, and it was therefore a matter of importance that the books should not be lost.

Mr. H. K. RUSDEN moved, "That a Committee be appointed to enquire into and report upon Cremation as a means of disposing of the dead, as well as other methods, the Committee to consist of Professors Kernot and Masson, and Mr. H. K. Rusden, with power to add to their number."

Dr. NEILD seconded the resolution.

The PRESIDENT explained that this was merely a motion for the re-appointment of an old Committee, which had first been appointed some time ago, when the question of Cremation had been brought forward by Mr. Rusden at the Australasian Association, since which time, however, little or nothing had been done. The re-appointment of the Committee did not commit the Society to any expression of opinion, but simply gave the Committee power to enquire into the various methods of disposing of the dead, and report at their leisure. Some people regarded the question of Cremation as one of very great importance, and without doubt it was worth investigation.

Mr. RUSDEN pointed out that it was scarcely correct to say nothing had been done, as some of the books in his possession bearing on the subject, had been read by the Members of the Committee, and so much time had therefore been saved.

The resolution was carried.

A paper, "On the Occurrence of the Genus Belonostomus in the Rolling Downs Formation (Cretaceous) of Central Queensland," by R. Etheridge, jun., F.G.S., Palæontologist to the Geological Survey of New South Wales, and Arthur Smith Woodward, F.L.S., of the British Museum, was read by Professor W. BALDWIN SPENCER. Some lithographs of the specimen were handed round among the Members.

Mr. SWEET said he had no doubt that very much more perfect specimens could be obtained by persons longer on the area than he himself had been. The fossil was somewhat under two feet in length, but as the fish was turned on itself, it was probably the intention of the writer to suggest the metre as the unit. The fossil was valuable, inasmuch as it helped to fix the geological period to which the area in which it had been found should be assigned. For some time past this area has been regarded as cretaceous, but its exact position in that period was as yet undetermined. The discovery of similar fossils would assist in determining this.

Professor SPENCER said it was an interesting fact that this fish was distributed over other parts of the world, and found in such places as Western Europe, Brazil, and India. It was most desirable that the Palæontology of Australia should be worked out. Mr. Sweet had taken considerable trouble in obtaining the

fossils, and were there more workers in that branch, the past life history of Australia and its relationship to other parts of the world would be better understood.

Professor W. Baldwin Spencer then read a "Note from the Biological Laboratory of the Melbourne University."

The President, in announcing this paper, congratulated the Professor on the solid character of the work being proceeded with at the University.

A short discussion then ensued, in which the President, Mr. Sweet, and the author took part.

Thursday, June 11th.

Mr. E. J. White, Vice-President, occupied the chair.

The minutes of the last Ordinary Meeting were read and confirmed.

Mr. Dawson was nominated as a Country Member, and Mr. J. Strettle as an Associate.

The Librarian's Report, that 175 publications had been received since last meeting, was read by the Chairman.

The Report of the Gravity Survey Committee was read by the Secretary, Mr. Love, who stated that it was necessary to appoint a new Committee, with power to add to their numbers.

Professor Spencer moved that the Report be adopted.

The motion having been seconded by Mr. Love, was put and carried.

On the motion of the Chairman, seconded by Mr. Griffiths, the old Committee was re-appointed, Mr. Russell, Government Astronomer of New South Wales; and Mr. Todd, Government Astronomer of South Australia, being added to it.

Mr. Love stated that, if the pendulums mentioned in the Report were secured, a considerable advantage would be gained, even though the Society might be able to arrange for only a small number of observations. Those observations would be directly comparable with some hundreds that had been made in different parts of the world, but none of them in the hemisphere in which Australia is situated. The Committee considered that the observations should be made in one or two places as nearly due north of Melbourne as was possible. It would be advantageous if one could be made at Thursday Island, and one between Thursday Island and Melbourne. The Committee considered also, that as far as Australia is concerned, a set of observations at six or seven different places would give nearly as much information as could

be got. Those observations would not give information as to very minute points relating to local disturbance of gravity. What the Committee was aiming at was the general result as regards the earth. It was also suggested that an observation should be made in Western Australia, probably at Perth. This would be of value, as a check on those made on the other side of the continent.

The CHAIRMAN said that plenty of observations had already been taken in Australia by several nations, but they had been confined to the coasts. The extension of railways into the interior would enable the apparatus to be taken there, and observations there would be of as much value as those made at the coast. The Society would be doing a good work in carrying out this survey.

Professor BALDWIN SPENCER read a paper "On the Anatomy of Ceratella fusca (Gray)."

Dr. DENDY read "Additional Observations on the Victorian Land Planarians."

In reply to a question, Dr. DENDY said that each locality appeared to have its own particular group of species. It would be impossible to state the number of specimens in each locality. At Macedon, a large number were seen on one occasion, but at a later period not a single one could be found.

Mr. HOGG corroborated the last speaker.

Dr. DENDY said that the planarians referred to in the paper occurred in large numbers.

The CHAIRMAN said that worms were more plentiful now than in the days when the colony was first occupied by white people. Not one was to be found at Castlemaine or Sandhurst in the early days.

Dr. DENDY said that planarians were found in the virgin forests where there was plenty of timber.

Professor SPENCER, in the absence of the writer, Mr. A. H. S. Lucas, read a paper "On a New Species of Fresh-water Fish from Lake Nigothoruk, Mount Wellington, Victoria."

Professor SPENCER read a paper "On Land Planarians from Lord Howe Island."

The reading of a paper by Dr. DENDY, entitled "Description of an Australian Species of Land Nemertean," was postponed.

Thursday, July 9th.

The President (Professor KERNOT) in the chair.

The minutes of the last meeting were received and confirmed.

Professor SPENCER gave notice that, at a Special Meeting to be called, he would move certain alterations in the Rules. The purport of the alterations would be, to provide for one Secretary of the Society in place of two as at present. He would suggest that the Special Meeting be held on the same evening as that set apart for the next Ordinary Meeting.

The PRESIDENT.—There will be no difficulty as to that.

Mr. ELLERY said that a vacancy in one of the offices of Vice-President existed. The matter had been brought before the Council at its last meeting, and in accordance with a resolution then arrived at, he had much pleasure in nominating Mr. H. K. Rusden as a Vice-President of the Society. Mr. Rusden had been a Member of the Society for a great many years, and he had acted as Secretary of it for a long period. In two epochs he had so acted, and on many occasions had contributed most interesting papers. Mr. Rusden was one of their most valued Members.

The PRESIDENT mentioned, for the benefit of those Members to whom the nomination might possibly come as a surprise, that Mr. Cosmo Newbery had been for many years a Vice-President of the Society. As would probably be remembered, Mr. Newbery a few years ago was severely injured in a disastrous railway accident. After that, he was for a long while absent from the Colony, and when he returned, he was very far from being in his full health and strength. He had again left the Colony. His sympathies were always with them, and in the years gone by, he had been a most valuable Member and officer of the Society. Under the circumstances just related, his name was retained for several years on the list of officers as Vice-President, in the hope that he would regain his strength sufficiently to enable him to take as active a part in the Society as he had in previous years. Not long since, he had undertaken a mission from the Government which would entail his absence from the Colony for a considerable time. He then resigned his position, and that resignation the Council had no choice but to accept. They regretted his loss, but considered the acceptance of the resignation the best that could be done under the circumstances. Mr. Rusden, who had served the Society so well for a number of years as Secretary, Member of Council, and reader of papers, had been nominated as successor to Mr. Newbery. In that nomination, he (the President) concurred most heartily. The ballot would take place at next meeting.

Mr. Wm. Lowell Mullen, M.A., M.D., was nominated as an Associate.

Professor Laurie signed the Roll of Members, and was introduced to the meeting by the President.

Elections.

Mr. John Dawson was elected as a Country Member, and Mr. W. Stratford Strettle, jun., as an Associate.

The President, in the absence of Dr. Neild the Hon. Librarian, announced that seventy-three publications had been received during the last month.

Antarctic Committee's Report.

The President read the Report of the Antarctic Committee, and stated that it was read at the public meeting in the Athenæum a few evenings ago. Mr. Robert Reid was then present, and made a donation of £1000 to the Fund. The Report was the most satisfactory one the Committee had submitted, and the sum in hand was greater than what was first proposed. Originally, an expedition to cost £10,000 was spoken of, but it had grown into one to cost £15,000. It was, however, hoped that £20,000 would be raised, so as to allow of a margin, and to carry out the expedition in the best style. The state of affairs in Australia was communicated as quickly as possible to their Swedish friends, who were commencing active preparations for fitting out the expedition. In about fourteen or fifteen months from the present time, the ship or ships of the expedition would probably be seen in Hobson's Bay with the veteran Arctic navigator Nordjenskold on board one of them. The objects expected to be attained were primarily scientific, but it would be quite possible that facts of vast commercial importance would be also obtained.

Replying to Professor Spencer, the President stated that it was part of the original arrangement that Baron Nordjenskold should lead the enterprise, and the only fear was that his advancing years would prevent it.

Mr. Ellery understood that it would be led by the Baron or his son.

Mr. Rusden said that although he was unable to produce any authoritative document, yet it was understood that the Baron would lead. One cablegram stated that the second vessel would be lead by the son, who would investigate the opposite side of the circle. He did not know of anyone more suitable to lead the expedition than the Baron, and the arrangements had been left entirely to him. It had been stipulated that two scientific men should be sent by Victoria.

Mr. Ellery.—Australia.

Mr. Rusden.—The Antarctic Committee was in possession of the names of Professor Spencer and Mr. Wragge, of Queensland, as likely to go. Australia should be entitled to send no

fewer than four scientists, as its contribution was double that originally proposed.

Mr. WHITE considered it would be a poor return to Victoria if only two of her scientists were allowed to go.

Mr. ELLERY considered an expedition costing only £15,000 would be very economically conducted, as the British Government had estimated the cost at £45,000 or £50,000; the understanding at first was that it was not to be purely a scientific expedition.

Mr. RUSDEN.—The original arrangement stipulated that £5000 should be contributed by Australia. Now that that sum had been exceeded once, further stipulations as were necessary should be made with the Swedish Academy.

The PRESIDENT considered that a biologist and a meteorologist should go, and possibly a geologist. If any of them could combine photography, it would be advisable. In his opinion, three scientists from Australia would be sufficient. He thought the Royal Society might rest satisfied that the Antarctic Committee would see that the vessels started from an Australian port, and that the expedition should be recognised as a Swedish-Australian one.

PAPERS.

Dr. DENDY read a paper entitled "Description of an Australian Species of Land Nemertean."

At its conclusion, the PRESIDENT congratulated Dr. Dendy on his work.

Replying to the President, Dr. DENDY stated that the proboscis was ejected by the pressure of a fluid. The size of the proboscis was remarkable. It was longer than the animal, and he could not explain how it was packed when drawn in, as it was done in a mysterious fashion. He could not tell what the animal fed on, but it probably captured its prey by spearing it. There was a sticky slime at the end of the proboscis, and to that the prey would adhere and be drawn in. There was nothing akin to budding in the re-productive organs.

Mr. ELLERY read a paper on "The Present Stage of the International Photographic Charting of the Heavens," and exhibited a number of photographs. Some of them were reproduced by the oxy-hydrogen lantern by Mr. A. M. Henderson, C.E.

Thursday, August 13th.

The President (Professor KERNOT) in the chair.

The minutes of the preceding meeting were read and duly confirmed.

Mr Dudley Dobson, M.I.C.E., F.G.S., of Warrnambool, was nominated as a Member.

Dr. Wm. L. Mullen, M.A., M.D., was elected as an Associate of the Society.

The PRESIDENT said he regretted having to make the announcement that Mr. Howitt had felt compelled to resign his position as a Member of the Council, owing to the pressure of official duties. It would, therefore, be necessary to fill the vacancy by ballot, in accordance with Rule 13.

Mr. WHITE nominated Dr. Dendy, and Professor SPENCER seconded the nomination.

No other nominations being forthcoming, the PRESIDENT said it was his duty to declare Dr. Dendy duly elected a member of the Council of the Royal Society. He desired to express his satisfaction at Dr. Dendy being added to the membership of the Council. He had been so very active in connection with the Society, that he felt sure he would be equally active as a Member of the Council.

Dr. DENDY thanked the Members for the honor they had done him, in electing him to fill such an important post, and trusted he would be able to perform the duties connected with it to the satisfaction of the Society.

Dr. NEILD, the Hon. Librarian, reported that 172 publications had been added to the Library since the last meeting.

PAPERS.

Dr. DENDY read a paper entitled, "On the Mode of Reproduction of Peripatus leuckartii."

Mr J. BRACEBRIDGE WILSON remarked that the structure of the reproductive organs of the species described by Dr. Dendy appeared to differ from that of species hitherto described.

Dr. DENDY said the structure of the reproductive organs was essentially the same. There were only some superficial points of difference.

Mr. J. B. WILSON said that a remarkable point in the structure of these organs was the presence of two curious little sacs, which held the spermatic fluid, and fertilized the eggs as they passed down. That seemed to indicate that the female was fertilized perhaps only once in its life.

Dr. DENDY said that, in this point Peripatus leuckartii agreed with the other species. In regard to the lower part of the oviduct, however, there certainly was a difference. In other species, the uterus was specially modified to allow the embryos to develop

in it, the embryos themselves producing placenta whereby they drew nutriment from the mother. There was nothing of this kind to be found in the Australian species. The eggs were simply fertilized, and the shell then developed around them.

The PRESIDENT asked whether there was any uncertainty in the mode of reproduction. For instance, might it sometimes be oviparous and sometimes viviparous?

Dr. DENDY thought there could be no doubt that it was always oviparous. If it were not so, the egg would not be so beautifully sculptured. The viviparous species could not be said to be just viviparous, for they were so viviparous that the young were said to remain in the uterus for no less than thirteen months, and did not leave the parent until they were fully developed. In view of the facts that the egg shell was sculptured, and that there was no trace of embryo in the egg when laid, he thought the species to be truly oviparous.

Dr. DENDY next read a paper entitled, "Short Descriptions of New Land Planarians."

The PRESIDENT asked whether the species of the land planarian were definitely marked off from each other, or whether there was a series of slightly varying individuals connecting one species with another.

Dr DENDY said there was a gradual series. Land Planarians were, perhaps, one of the best illustrations of Darwin's theory of evolution. All the connectlng links were apparently still present. Of course, there were no such things as different species in nature; there had been connecting links at some time. Fortunately, all the planarians remained. Still, he thought it convenient to have a name for each. As a rule, the species in each locality were tolerably constant; and although there were connecting links between them, he did not think that a reason for not using distinct names for each.

Professor SPENCER then exhibited, and read a few notes upon, *Notoryctes typhlops*, the new Australian mammal recently described by Dr. E. C. Stirling.

The PRESIDENT remarked that it seemed strange that a blind animal should come above ground so constantly. Would it not be subject to great danger in so doing?

Dr. DENDY suggested that as it was a desert country there would be hardly anything to molest it.

Mr. J. B. WILSON said it would be interesting to know whether the organ of smell was specially developed. It seemed extraordinary that a perfectly blind animal should be able to get its food, unless it had some special provision of the sort.

rra was made the land had become covered with buildings. hoped an effort would be made to collect these records. The papers published at the time were Strode's and Fawkner's. was very important indeed that some Institution like the l Society should try to collect these things, and to bring the notice of the Government the importance of doing ing in this direction. Some time ago it had been found original plans and maps at the Crown Lands Department tting torn and defaced, and a Committee had been l to consider the best way of keeping them. Not only he original plans be preserved, but any documents the history of the Colony.

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ENT said he felt sure that any information that was uld be obtained and placed on record without any ould be very glad if someone would endeavour to particulars, as they would form a very useful s paper. He thought the flood of 1878 was very present one. He had to confess he had not ble in the way of investigating the matter; but l told him that he had arranged the water pipes r at the Kew Asylum, and put them five feet the water in 1878, and during the recent flood ve feet under the water. The flood of 1878, appear to possess any particular interest. blic Works Department, he had been able to er the most minute information as to the he way down to the Dight's Falls. If that e obtained with regard to previous floods it resting. The papers during the year 1864 d with criticising certain schemes for reducing y the flood, and did not trouble to include e height of the flood itself. The Public Works nished him with what purported to show the of 1863 up as far as the railway bridge at yond that he could obtain no information. s shown by the wharves down at Prince's nder's Ferry. Going towards the Cremorne re was not more than about three inches If the figures given meant the height of the i the 1863 flood was three or four he Public Works Department out identical. Mr. Gordon of the engineers of the 1863 lower than

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Wharf, whereas the water in the river was about a foot below the South Wharf. The water in Normanby Road appeared to flow out of the river about half-way between Prince's Bridge and Queen's Bridge. Leaving the river at this point, the water appeared to make its way between a number of streets and lanes, and flooded Moray Street and Normanby Road up to the level of the top of the South Wharf (whilst in the river it was much lower), escaping in a cascade at the landing place of the steam ferry, near Clarendon Street. When the improvements between the Queen's Bridge and Prince's Bridge were finished this would be entirely avoided; and had these improvements been completed at the time, he did not think there would have been any water in South Melbourne. Besides this, the Queen's Bridge had not had a fair chance on this occasion, it having been completely blocked by the wreck of a dredging apparatus which had been placed there for the purpose of improving the river.

Mr. Griffiths said that the data supplied by Professor Kernot seemed to him to point to a danger in the future that had not been discussed so far. They had been given the sectional area under one of the upper bridges, and the velocity and amount of the water that passed under that bridge during the three days of the rain storm. The water that passed under that bridge was estimated to be enough to cover the whole of the watershed of the Yarra to a depth of two and a quarter inches. It was well known, that the watershed of the Yarra constituted one of the wettest portions of Victoria. The rainfall there was always greater than the rainfall in Melbourne, or any other part of the Colony. The rainfall in Melbourne during the three days of the rain storm was five inches, nearly three inches more than the amount of water that apparently must have covered the watershed, gauging the amount by the quantity that passed under the bridge. It was well known that, where rain fell on non-absorbent soil, clear of obstructions, it got away immediately, and with tremendous velocity; but where the rainfall took place in a forest country, such as the watershed of the Yarra, it got away very slowly, and probably took months to be got rid of entirely. Now, it was almost certain that six, and perhaps seven, inches of rain had fallen over the watershed, and the reason why two and a quarter inches was all that got away during the three days was, that the whole of the country was a forest country, that the surface was absorbent, and covered with obstructions in the way of timber and bush and scrub, which caused the whole surface to act as a sponge, to hold the water and discharge it slowly and spread its discharge over a long period of time. Now this watershed was being cleared. It was being crossed by roads, every one of which had its gutters discharging into it. The land was being taken up for farming purposes; and the rain got away much

more quickly off a farm than off a similar area of virgin forest. This process of reclamation would go on until a very large portion of this area would be in a very different condition to that in which it was at the present time. In the future, the water over that area would be discharged very much more rapidly than it was to-day. What, under such circumstances, would be the condition of the lower Yarra, and to what height would the water in the Yarra rise? It would come down faster than it could get away, and the flood would be greater than ever. This danger seemed to threaten us in the future, and this showed the importance of taking every possible means to clear the lower regions of the Yarra, so as to allow the water a greater sectional area. He would like to ask what was the difference in sectional area between the Richmond Railway Bridge and the Railway Bridge below Prince's Bridge, and what amount of increased water way at the Richmond Bridge would have to be given by the railway authorities in order to give the water the same facilities for getting away as it had in the City; for on that depended the amount of work to be done to give the same relief at South Yarra as was enjoyed at the lower Railway Bridge.

Professor KERNOT, in reply, said that the sectional area between Queen's Bridge and Prince's Bridge would be ample as soon as the excavations were completed. As to the difference in area between the Queen's Bridge and Richmond Bridge, of course the Queen's Bridge was much longer. The difference was about 50 per cent. The sectional area at the Richmond Bridge would still further be reduced when the river was improved about there. The benefit would be felt in Richmond, but not in South Yarra, while the rush through the bridge would be increased to an extent that would probably be dangerous to the bridge itself. It seemed to him that an enlargement of the bridge was inevitable.

On the motion of Mr. GRIFFITHS, seconded by Dr. NEILD, the discussion was adjourned till the next meeting.

Thursday, September 10th.

The President (Professor KERNOT) occupied the chair.

The minutes of the preceding meeting were read and duly confirmed.

Dr. NEILD, the Hon. Librarian, announced that 61 publications had been received since the last meeting.

The PRESIDENT said he was just arranging to leave the Colony for Europe, and consequently that would be the last meeting at which he would be able to be present this year. He had to

thank the members for so kindly electing him as their President, and thought the most orderly way would be for them to give him leave of absence till his term of office expired.

Mr. Rusden moved that leave of absence be granted.

Mr. White said he had great pleasure in seconding the motion. He thought it was usual for the Council to deal with such matters, but that was no reason why it should not be dealt with there.

The motion was carried.

The adjourned discussion on Professor Kernot's paper, entitled "Notes on the Recent Flood on the Yarra," then took place.

The President said he had re-written the latter portion of his paper, but had made very few alterations. He had re-written it mainly with the object of including in it the revised levels furnished by the Public Works Department. Last month the Inspector General had given him a list of the levels taken by his officers, but these had not been thoroughly checked. He had now received the revised levels, but the difference was only trifling, and, as a rule, did not exceed two or three inches at any given spot. With that exception the paper remained practically as it was when read on the last occasion.

Mr. White said he was surprised to learn of the absence of records at the Public Offices. As to the flood of 1863, there was a great difficulty in finding records. As to the flood of 1849, years ago there was a plan in the Public Works Office, containing a view of the scaffold of what was then called the new Prince's Bridge, on which the highest level was recorded. Had the President seen that?

The President.—I have not heard of it before.

Mr. White said that he had referred at the last meeting to the flood of 1839. It appeared that there were scarcely any records of the flood; but in *The Argus* of Saturday, September 5th, there was an extract from Mr. Robert Russell's diary. Mr. Robert Russell was Surveyor in Melbourne then, and laid out the town, and was superseded by Mr. Hoddle, who sold the allotments. In his diary he referred to the flood of December 1839. Mr. Skene, the late Surveyor General, had at that time arrived in Melbourne, and he said the flood of 1839 was very much more pronounced than the recent one. Melbourne had at that time been laid out about two years, and the Government thought the flat land south of the Yarra would be a splendid site for a town, but the flood came down on the very day that the sale was to have taken place, and there was water to the depth of ten or twelve feet on it. The Government had, therefore, come to the conclusion that it would not do to sell the land; but since the new course of the

Yarra was made the land had become covered with buildings. He hoped an effort would be made to collect these records. The newspapers published at the time were Strode's and Fawkner's. It was very important indeed that some Institution like the Royal Society should try to collect these things, and to bring under the notice of the Government the importance of doing something in this direction. Some time ago it had been found that the original plans and maps at the Crown Lands Department were getting torn and defaced, and a Committee had been appointed to consider the best way of keeping them. Not only should the original plans be preserved, but any documents relating to the history of the Colony.

Dr. NEILD quite agreed with Mr. White as to the desirability of taking care of such records.

The PRESIDENT said he felt sure that any information that was obtainable should be obtained and placed on record without any delay. He would be very glad if someone would endeavour to obtain such particulars, as they would form a very useful addendum to his paper. He thought the flood of 1878 was very much below the present one. He had to confess he had not taken much trouble in the way of investigating the matter; but Mr. Davidson had told him that he had arranged the water pipes crossing the river at the Kew Asylum, and put them five feet above the level of the water in 1878, and during the recent flood these had been five feet under the water. The flood of 1878, therefore, did not appear to possess any particular interest. Thanks to the Public Works Department, he had been able to include in his paper the most minute information as to the present flood all the way down to the Dight's Falls. If that information could be obtained with regard to previous floods it would be most interesting. The papers during the year 1864 were rather concerned with criticising certain schemes for reducing the damage done by the flood, and did not trouble to include actual figures as to the height of the flood itself. The Public Works Department had furnished him with what purported to show the height of the flood of 1863 up as far as the railway bridge at South Yarra, but beyond that he could obtain no information. The flood level was shown by the wharves down at Prince's Bridge, and up to Brander's Ferry. Going towards the Cremorne Railway Bridge there was not more than about three inches between the floods. If the figures given meant the height of the water above the bridge, then the 1863 flood was three or four inches below the recent one. The Public Works Department thought that the two floods were about identical. Mr. Gordon had prepared a plan, now in the possession of the engineers of the Department, according to which the flood of 1863 was lower than

the present one at Hawthorn, but seemed to rise again at Dight's Falls. According to Mr. Gordon, the 1863 flood had been about equal to the present one between Richmond and South Yarra and below that was higher than the present flood. Mr. Gordon had left for England before he had discovered this anomaly, and he had, therefore, not been able to get much information.

Mr. WHITE said that the Yarra before 1863 was full of snags, which would probably cause a great number of weirs.

The PRESIDENT said the 1863 flood was some feet lower than 1891 flood, from the Hawthorn Railway Bridge to the Johnston-street Bridge. If the 1891 flood had been lower than the 1863 one, it might possibly be explained by the snags; but why should it be higher? The Victoria-street Bridge was the largest on the river, and consequently made the least obstruction.

Dr. DENDY gave a summary of a paper by Mr. J. B. Pritchard, entitled "On a New Species of Graptolitidæ (Temnograptus magnificus)."

Dr. DENDY read a paper "On the Presence of Ciliated Pits in Australian Land Planarians."

As there were not a sufficient number of members present to form a quorum, the elections were postponed until the next ordinary meeting.

Thursday, October 8th.

In the absence of the Secretary, Dr. DENDY read the minutes of the preceding meeting, which were duly confirmed.

NOMINATIONS.

Dr. J. W. Barrett was nominated as a Member, and Miss Agnes Murphy as an Associate.

Mr. H. K. Rusden was elected as Vice-President, *vice* J. Cosmo Newbery, C.M.G., resigned; and Mr. A. W. Dobson, F.G.S., was elected as a Member.

Mr. R. L. J. ELLERY read a paper entitled "Notes on the Magnetic Shoal near Bezout Island, North-west Australia."

Mr. ROSALES asked what was the geological formation of the Island?

Mr. ELLERY said that the mainland (of which the Island had evidently once formed a part) and the Island itself contained a good deal of iron sandstone. A good deal of hematite was found on the mainland, and a few hematite blocks were also to be seen on the Island; but no specimen of truly magnetic iron ore had been found either on the Island or mainland. As a

matter of fact, the hostility of the natives rendered it a difficult matter to carry on geological exploration and on some occasions exploring parties had narrowly escaped spearing. The magnetic action of the shoal was exactly similar to what would be produced by a ridge of magnetic iron ore. At that place the water was only about 75 feet deep.

Mr. ROSALES said that in going about Ballarat his compass was very often affected in the way that had been described. In some places the granite had become greatly decomposed, and formed a magnetic iron ore.

Mr. ELLERY said that there were a good many magnetic centres on basalt formations in the Colonies.

Mr. WHITE said that in Madagascar and other places it had been found necessary to disregard the compass altogether for the purposes of surveying, and indeed, he was astonished, not at so many wrecks taking place, but at so few. Flinders, who was not equalled as a careful navigator in his day of wooden ships, had stated that in his opinion, by extreme care a course could be made good to a quarter point, or three degrees, about one mile in nineteen. It was nothing unusual in these days for a ship to run 400 miles in twenty-four hours, and thus, by trusting to the compass, a navigator could not make for any point with greater certainty than that he would arrive at within twenty miles of it. When captains of vessels found themselves out of their course, they generally set it down to the action of some unknown current. His impression was that it was generally due to some abnormal action of the compass. In fact, anyone who would trust the compass for absolute direction would be a madman.

Mr. LUCAS asked if Mr. Ellery could give any reason why the north-seeking pole should be uppermost. He thought the iron ore would attract either pole.

Mr. ELLERY said it was only surmise. Judging from the effect produced, that was the conclusion that seemed most probable.

Mr. ROSALES said that if the deflection of the needle were due simply to a large mass of magnetic iron ore, the deflection would be greater and greater as the ship neared the Island, but there would be no deflection to the other side.

Mr. ELLERY said that no doubt the mineral, whatever it was, was polarised.

Mr. LUCAS asked whether it could become polarised by lying in a certain position.

Mr. ELLERY replied that if it were lying anywhere parallel to the magnetic axis, it would become polarised. As the Chairman

had said, when mistakes in navigation were made, people generally looked out for currents to excuse them, but in nine cases out of ten it was caused either by manifest carelessness, or by some defect in the compass. In some parts of the world—and this was the case on the Australian coast—certain classes of fogs disturbed the compass very much, and sometimes dangerously so. There was no doubt about this being a fact, although it was not generally believed, because many Captains of ships had been in fogs and had never noticed it. Certain fogs occurred sometimes in Port Phillip that threw the compass off a great number of degrees and when he had been first informed of this, a few years ago, he had been at a loss to account for it. But all old and trustworthy mariners spoke of having experienced it, and he thought it quite possible, because in this country a certain kind of fog sometimes prevailed on the mountains and plains and over the Bay that seemed to form an electric couple with the surface of the earth, or rather with a layer of atmosphere varying from five to ten feet thick, and if during the continuance of the fog, one explored between the surface of the earth and say five or six feet above it, and perhaps five or six feet above that, it would be found that there was a space with scarcely any tension whatever, whilst below there would be a tremendously strong positive tension, and above a tremendously strong negative tension. In fact, one would imagine that were very much more disturbance to take place, there would be flashes of lightning. This state of things would continue for some hours, and then all would become balanced again, and the two layers would be equally electrified. He had experienced this some three or four times. He had read a paper a good many years ago, giving some observations he had made on Mount Macedon. These observations were always made in a fog. The registrations at the Observatory made with the electrometre showed signs of this state of the atmosphere existing for short periods of time. From this it would be easy to see that some fogs must disturb a ship's compass, and it was only fair to captains of vessels that this should be known.

A Member said that an old resident of Apollo Bay had once remarked to him, that sometimes the weather at that place was so bad that it turned the compass round, and assured him that in certain fogs compasses were quite unreliable.

Mr. E. F. J. Love, M.A., read portions of a letter received by him from Sir George Stokes, President of Royal Society of London, concerning the Gravity Survey of Australia.

Mr. Ellery said he had received a letter a week or two ago from Mr. Wipple, of Kew, who said the pendulums were being made ready to be sent out. In a previous communication, he (Mr. Ellery) had mentioned that the Council had voted a sum to

pay the expenses of their transportation, and asked that the pendulums should be sent as soon as possible. Mr. Wipple now stated that they would cost about £24 or £25 to pack and send away, and as he did not know whether the vote would cover that amount, he would await a reply. That was how the matter stood at present. The information given by Sir George Stokes would be very valuable in helping them to decide what was to be done, and he was inclined to think that the work would be more valuable and likely to be better done if new pendulums were made. A great deal of trouble had been experienced with the old pendulums in India, and they had seen a good deal of work. The Americans when near Australia a few years ago had used a small invariable pendulum made in America for their observations, but so far as he had been able to ascertain, the work was not very satisfactory.

Mr. LOVE said that from the drawings he had seen, he thought the construction of the Russian pendulum was very bad. From an engineering point of view, it was weak where it should have been strong, and *vice versâ*. He objected more particularly to the shape. As a matter of strength of materials, it was just as bad as it could be.

Mr. A. H. S. LUCAS, M.A., B. Sc., read a paper entitled "Notes on the distribution of Victorian Frogs, with description of two new species."

Dr. DENDY said Mr. Lucas was to be congratulated on his work in connection with Victorian vertebrates. He had now added very materially to our knowledge of the higher animals of Victoria, and several new species were due to his researches.

Mr. WHITE said that forty years ago the noise made by the frogs at St. Kilda could be heard miles away.

Mr. LUCAS said he thought the noise was made by the green and gold bell frog. The common frog was a tree-frog, which had taken to the water. Its discs, which, though reduced, were still present, showed that it belonged to that order. The green and gold frog was the loudest.

Dr. DENDY said that at the University many hundreds of frogs were used in the dissecting-room, and they found that the male frog's vocal organs were much more largely developed than the female's, and in a different form, and specially adapted for making a great noise. He inferred from this that the male did most of the croaking.

Mr. LUCAS said that that was so.

Thursday, November 12th.

E. J. WHITE, Esq., F.R.A.S. (Vice-President) occupied the chair.

Mr. RUSDEN, V.P., in the absence of the Hon. Secretary through indisposition, read the minutes, which were duly confirmed.

Messrs. Dobson and Williams signed the Roll and were introduced to the Members.

Dr. J. W. Barrett was elected a Member, and Miss Agnes Ross Murphy an Associate.

The Librarian's report was to the effect that, since the last meeting of the Society, eighty-five publications had been received.

Mr. RUSDEN read the report of the Antarctic Exploration Committee, and moved :—"That Professor Kernot, Mr. R. L. J. Ellery, C.M.G. and C., and Mr. Griffiths, F.R.G.S., be re-appointed Members of the Antarctic Exploration Committee, with power to add to their number."

Mr. GRIFFITHS seconded the motion, which was put by the Chairman, and carried unanimously.

Mr. RUSDEN read the report of the Port Phillip Biological Survey Committee.

Mr. LUCAS said that since writing the report, he had been informed that Mr. Wilson had received a communication from Professor Agardh, with regard to the algæ of Port Phillip. A large number of new species and genera had been added, and Mr. Wilson considered he would now be able to draw up a complete list up to date, and perhaps as nearly as possible altogether complete of the algæ of Port Phillip, which would be published in a systematic form, in the same fashion as the catalogue of fishes.

Dr. DENDY said he thought the suggestion of Mr. Lucas in the report, that the material should be retained in the colony instead of being sent home, was a very wise one. A large number of things had been sent home at considerable expense, and, with the exception of a few cases, they had received no return for their labour. He thought that in the future it would be desirable to retain the material. They had a number of workers—old established workers, and workers coming on at the University, and he thought they would be able to deal with it themselves far more satisfactorily than by sending it home, and at much less expense. If the money were spent instead by buying the publications suggested in the report, it would be a permanent benefit to the scientific literature of the colony.

The CHAIRMAN said the suggestion was that the Public Library should obtain the books, and the Trustees of that

Institution had always shown themselves very willing to procure any technical work required. He certainly agreed with the proposition that as much of the work as possible should be done in the colony. Would it be necessary for the Council to approach the Trustees of the Public Library in the matter?

Dr. DENDY thought the first thing to be done was to get the individual naturalists in the colony to take up particular groups, and then these gentlemen might be asked to furnish the Committee with a list of the books they required. The Council might then be asked to obtain the books. He did not think the Public Library should be asked to obtain any books, until it was determined what books would be required.

Mr. LUCAS moved "That the Members of the Port Phillip Biological Survey Committee, viz., Mr. Wm. Bale, F.R.M.S., Rev. A. W. Cresswell, M.A., Dr. Dendy, Mr. A. H. S. Lucas, M.A. (Sec.), Mr. P. H. McGillivray, Professor W. Baldwin Spencer, M.A., Mr. J. Bracebridge Wilson, M.A." The resolution was carried.

Mr. RUSDEN read the Report of the Cremation Committee, and moved "That Professor Kernot, Professor Orme Masson, and Mr. H. K. Rusden, F.R.G.S., be re-appointed Members of the Cremation Committee." The resolution was carried.

On the motion of Mr. RUSDEN, the old Members of the House Committee, viz., Mr. C. R. Blackett, F.C.S., Professor W. C. Kernot, M.A., Dr. Neild, Professor Orme Masson, M.A., and Mr. H. K. Rusden, F.R.G.S., were re-appointed Members of the House Committee.

Mr. RUSDEN read the Report of the Gravity Survey Committee.

Mr. LOVE moved the re-appointment of the old Members of the Committee, viz., Mr. R. L. J. Ellery, C.M.G., Professor Kernot, M.A., Professor Orme Masson, M.A., Professor T. R. Lyle, M.A., Mr. E. J. White, F.R.A.S., Mr. E. F. J. Love, M.A., and at a later stage added the names of Messrs. Russell and Todd. The resolution was carried.

On the motion of Mr. RUSDEN, seconded by Mr. LOVE, Professor W. Baldwin Spencer, M.A., Mr. R. L. J. Ellery, C.M.G., Professor Orme Masson, M.A., Mr. G. S. Griffiths, F.R.G.S., were re-elected Members of the Printing Committee.

Mr. G. S. GRIFFITHS read a paper "On the Geology of the Barwon Heads."

Mr. DOBSON asked why, if the lava was horizontal when it flowed from the volcano, it should now be level and the upper beds tilted. His reason for asking the question was, that he had been very much puzzled to account for the formation of the rocks

on the south coast, near Warrnambool. The upper beds were evidently æölian. At present they were lying in the direction of the prevailing winds, and the lee side of the slopes, which were at an angle of about 32°, had evidently been very little disturbed. The slopes that were to leeward were the ones in which the quarries were worked. The seaward beds were very much disturbed, and if traced down to high-water mark would be found to be quite hard, instead of soft as at the top, and as in most modern beaches. But, as far as he could judge, the levels seemed exactly the same.

Mr. Griffiths said he was of opinion that whatever movement there had been had carried the whole of the locality up evenly, and lowered it again evenly, and that the divergence between the levels of the calcareous beds and the conglomerates intercalated between the calcareous beds and the levels of the old land surface which ran parallel to the lava bed surface, was not due to any tilting at all that had taken place in the locality (the beds having moved up and down together); but that the surface angles were due to the way in which the sandstone beds were deposited, or to the way in which those beds had eroded.

Mr. Dennant asked Mr. Griffiths if he had found any sign of any rock beneath the basalt. It would be interesting to know what rock was found underneath the basalt. He thought these deposits would be found underneath the basalt at the Barwon, if it could be penetrated. He would also like to know if there was any evidence as to whether that basalt was the newer basalt or the older basalt. That might afford some clue perhaps as to the age of the overlying rocks. As a matter of fact, the newer basalt was never overlaid by the limestone referred to by Mr. Griffiths. He knew of no instance of such being the case in any part of the colony. As Mr. Griffiths had hinted, the basalt might be continuous across the Straits, and possibly might extend right across to Western Port. With regard to the term "sandstone" he supposed Mr. Griffiths had used it as a common term. He believed it was composed mainly of portions of shell, the same as at Warrnambool. He had heard lately of an analysis of the Warrnambool sandstone, and, speaking from memory, he thought there was something like 95 per cent. of carbonate of lime in it. As to the doubt expressed by Mr. Griffiths with reference to the origin of the rocks—whether they were æölian or sedimentary—he would like to know whether any attempt had been made to isolate particles. He thought that might enable them to decide the question. If the particles of which the rocks were composed were angular, they were not sedimentary rocks; if they were rounded, they probably were sedimentary. Æölian rocks always had angular particles. He had no doubt that the rocks referred

to at Warrnambool were æölian, and the particles of which they were composed were never rounded, but always angular. Then again, it had been said that these rocks were Tertiary or Pliocene. He would like to know why they were called Pliocene or Tertiary. In the absence of fossil evidence, he did not know how it was to be decided whether the rocks belonged to one age or another, unless there was an underlying or an overlying rock to be guided by. In this case, there was neither. If they were æölian rocks, as represented by those at Warrnambool and further to the west, he would be inclined to catalogue them amongst recent forms.

Mr. Wilson asked whether it was probable that the flow of lava came from the neighbouring Mount Duneed. With reference to the rock above the basalt, had Mr. Griffiths noticed a capping of true limestone, or something approaching a true limestone, on the top, above what he called the calcareous sandstone. At Sorrento and Queenscliff there was a capping a good deal purer than what had been described. He could not help thinking that the capping on Barwon Heads bore some similarity to that which was found on the other side of the Straits. Mr. Griffiths had said that the lava did not show itself further west. By that it was to be presumed was meant that it did not show itself very close, because at a little distance the basalt came out again at a place commonly called the Black Rocks, about half way between the Barwon Heads and Bream Creek. As to its going across the Straits, he could not of course say positively ; it did not go some distance across the Straits, but in dredging off that place he had occasionally brought up boulders of basalt rock ; but a little beyond that distance, sandstone was met with, which he believed to be of the same character as the sandstone at Bream Creek, and which was also found on the opposite shore, in the immediate neighbourhood of Ocean Grove, which he had heard called Eocene.

The Rev. A. W. Cresswell asked Mr. Griffiths whether the age of the underlying volcanic rock could not be estimated by simply comparing it with the volcanic rock at Phillip Island. He presumed if it were recent rock it would be harder, to begin with, and would differ altogether in its mineral contents from the older Miocene basalt. A Miocene basalt was easily distinguished from a more recent one, partly because of its peculiar mode of decomposition, and its texture, softness, and so forth ; and partly by its mineral contents. He thought that under consideration very much resembled what one saw all along the coast, and especially at Phillip Island ; but he did not recollect the bands of conglomerates spoken of. Dr. Wilson had observed that these rocks had a capping of what appeared to be true limestone. He himself had observed that capping, and had noticed that it was

very solid. His opinion was that the whole of the rock was a plastic limestone. It was a form of comminuted shells; and here and there, owing to different causes, there had been a sufficient decomposition of the limestone, so to speak, to fuse masses of this plastic limestone on certain horizons.

Dr. DENDY read a paper on "Land Planarians from Queensland."

Mr. LUCAS remarked that it was strange that in the Queensland collection there should be so many genera and so few species.

Dr. DENDY said that Professor Spencer, who had collected the specimens described, had remarked that Queensland was not nearly so good a collecting ground for Land Planarians as Victoria.

Thursday, December 10th.

The minutes of the preceding meeting were read and duly confirmed.

Mr. GRIFFITHS stated that, at the last meeting of the Antarctic Exploration Committee, the question whether there should be two Secretaries had been raised. Hitherto, Mr. Rusden had represented the Royal Society as Secretary on the Committee, and the Royal Geographical Society had also been represented by a Secretary. Mr. Rusden having resigned this position, Baron von Mueller had raised the question as to whether the Royal Society should appoint a second Secretary.

Mr. ELLERY did not think there was any advantage to be gained by having two Secretaries, and moved "That nominations of members of the Royal Society to the Antarctic Committee be nominations of members only."

Mr. GRIFFITHS seconded the motion, which was carried.

Mr. Baker, Associate, and Mr. Oldfield, Member, signed the Roll, and were introduced to the meeting.

Messrs. J. Lillie McKay and A. E. T. Swanson were nominated as Members.

On the motion of Professor SPENCER, seconded by Mr. ELLERY, Messrs. Fenton and Moors were re-elected Auditors.

Professor SPENCER gave notice that, at the next General Meeting, he intended to propose certain amendments of the Laws of the Society, which would be fully set out in the notice paper for the March Meeting. These alterations had two objects, first, consequential alterations to allow of there being one Secretary instead of two, and second, amendments dealing with the Sections of the Society.

Mr. ELLERY called attention to an article which had appeared in *The Australasian* with respect to the Society, and which spoke of its decline and approaching fall. He had been connected with the Society from its inception, and he had not known a time in its history when it had manifested more real vitality in the work of the advancement of science. Perhaps the writer of the article in question had confused the work done by the Society with the proceedings of Section G, and if that were so, he could not wonder at the conclusions he had arrived at, if the reports of those proceedings were correct. As one of the oldest members of the Society, he was sure it was ahead in many respects of what it had ever been before; and although in earlier times a good deal of work of a popular kind might have been done, for original research and for good work, which would compare favourably with that done by any other Society, the present time had never been exceeded.

Professor SPENCER said he had interviewed the Editor, who had promised to insert a letter with regard to the matter, and read a letter which he had written accordingly.

The Hon. Librarian reported that since the last meeting 83 publications had been received and added to the Library.

Professor SPENCER read a Preliminary Notice of Victorian Earth-worms. Part I.—The genera Megascolides and Cryptodrilus.

After a short discussion, Professor SPENCER observed that an interesting point in regard to the earth-worms of Victoria was that they did not seem to throw up the soil at the mouth of their burrows to the same extent as European earth-worms. What Professor Drummond had said with regard to Africa seemed to be perfectly true with regard to Victoria, that in the matter of throwing up the earth, the ants took the place that was taken by the earth-worms in other parts of the world.

Professor SPENCER read a note on the habits of Ceradotus forsteri.

Mr. ELLERY asked whether it had not been stated that the Ceradotus was a migratory fish?

Professor SPENCER replied that it could not be a migratory fish as its limbs were not strong enough to support it out of water. It was found only in two rivers, the Mary and the Burnett, and nowhere else.

Mr. BAKER said that in the Murray District it was a commonly accepted idea that the fish would cross from pool to pool.

Professor SPENCER said that such an idea was erroneous. He had tried the fish out of water, and had come to the conclusion that it was unable to move.

On the motion of Mr. Ellery, seconded by Mr. Griffiths, it was resolved that the papers entitled "Notes on Victorian Rotifers," by Messrs. H. H. Anderson and J. Shephard, and "A Note on the Amphioxus of Port Phillip," by Mr. A. H. S. Lucas, should be printed in the Transactions of the Society, subject to the approval of the Secretary.

On the motion of Mr. Ellery, seconded by Mr. Griffiths, it was resolved that letters of condolence be sent to the widows of the late Dr. Perry and Sir William McLeay.

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SCOTLAND.

Botanical Society	Edinburgh
Geological Society	Edinburgh
Royal College of Physicians' Laboratory	Edinburgh

Royal Observatory	Edinburgh
Royal Physical Society	Edinburgh
Royal Society	Edinburgh
Royal Scottish Society of Arts	Edinburgh
Scottish Geographical Society	Edinburgh
University Library	Edinburgh
University Library	Glasgow

Ireland.

Natural History and Philosophical Society	Belfast
Royal Dublin Society	Dublin
Royal Geological Society	Dublin
Royal Irish Academy	Dublin
Trinity College Library	Dublin

Germany.

Gessellschaft für Erdkunde	Berlin
Grossh. Hessische Geologische Anstalt ...	Darmstadt
Königl. Botanische Gesellschaft	Regensburg
Königl. Offentl. Bibliothek	Dresden
Königl. Preussische Akademie der Wissenschaften ...	Berlin
Königl. Sächs Gesellschaft der Wissenschaften ...	Leipzig
Königl. Societät der Wissenschaften ...	Göttingen
Naturforschende Gesellschaft	Emden
Naturforschende Gesellschaft	Halle
Naturforschende Gesellschaft	Leipzig
Naturhistorisch Medizinischer Verein ...	Heidelberg
Naturhistorische Gesellschaft	Hanover
Naturhistorisches Museum	Hamburg
Naturhistorisches Museum	Hanover
Naturwissenschaftlicher Verein	Bremen
Naturwissenschaftlicher Verein	Frankfurt
Oberhessische Gesellschaft für Natur & Heilkunde ...	Giessen
Schlesische Gesellschaft für Vaterländ. Cultur. ...	Breslau
Verein für Erdkunde	Darmstadt
Verein für Erdkunde	Halle
Verein für Naturkunde	Kassel

Austria.

K. K. Akademie der Wissenschaften	Wien
K. K. Geologische Reichsanstalt	Wien

K. K. Geographische Gesellschaft ... ... Wien
K. K. Naturhistorisches Hofmuseum ... ... Wien
Imperial Observatory ... ... Prague

Switzerland.

Geographische Gesellschaft ... ... Berne
Geogr. Commerc. Gesellschaft ... ... St. Gallen
Geogr. Commerc. Gesellschaft ... ... Aarau
Schweizerische Naturforschende Gesellschaft ... Berne
Société de Physique et d'Histoire Naturelle ... ... Genève

France.

Académie des Sciences et Belles-Lettres et Arts ... Lyon
Feuilles des Jeunes Naturalists ... ... Paris
Société Académique Indo-Chinoise ... ... Paris
Société de Géographie ... ... Paris
Société Nationale de Cherbourg ... ... Cherbourg
Société Zoologique de France ... ... Paris

Italy.

Biblioteca Nazionale Centrale Vittorio Emanuele ... Rome
British and American Archæological Society ... Rome
Museo di Zoologia ed Anatomia Comp., R. Universitá Turin
Ministero dei Lavori Pubblici ... ... Rome
Reale Academia di Scienze ... ... Palermo
Reale Academia di Scienze, Lettre ed Arti ... ... Lucca
Regia Academia di Scienze, Lettere ed Arti ... Modina
Societá Geografica Italiana ... ... Rome
Societá Toscana di Scienze Naturali ... ... Pisa

Spain and Portugal.

Real Academia de Ciencias Exactas, Fisicas y Naturales Madrid
Sociedade de Geographia ... ... Lisbon

Holland and Belgium.

Académie Royale de Belgique ... ... Bruxelles
Bataviaasch Genootschap van Kunsten en Wetenschappen ... ... Batavia
Natural Science Society ... ... Amsterdam

Natuurkundig Genootschap	Groningen
Nederlandisch Botan. Vereeinging ...	Nijmegen
Magnetical and Meteorological Observatory ...	... Batavia
Société Hollandaise des Sciences	... Haarlem
Société Macologique Royale de Belgique ...	Bruxelles
Société Provinciale des Arts et Sciences ...	... Utrecht

DENMARK, SWEDEN, AND NORWAY.

Académie Royale	Copenhagen
Kongelige Danske Videnskabernes Selskap ...	Copenhagen
Société des Sciences	Christiania

RUSSIA AND ROUMANIA.

Institut Météorologique de Roumanie ...	Bucharest
Jardin Botanique Impérial	St. Petersburg
La Soc. de Naturalists de l'Université de Kazan	... Kazan
Soc. de Naturalistes Kiew	... Kiew
Société des Naturalistes de la Nouvelle Russie	... Odessa
Société Impériale des Naturalistes ...	... Moscow
Société Impériale Russe de Géographie ...	St. Petersburg

INDIA AND MAURITIUS.

Royal Asiatic Society, Ceylon Branch ...	... Colombo
Geological Survey of India	... Calcutta
Madras Literary Society	... Madras
Meteorological Society	... Mauritius
Natural History Society	... Bombay
Royal Bengal Asiatic Society	... Calcutta

CHINA AND JAPAN.

Astronomical Observatory	Hong Kong
China Branch of the Royal Asiatic Society ...	... Shanghai
Imperial University	... Tokio
Seismological Society of Japan	... Tokio

CANADA.

Canadian Institute	... Toronto
Geological and Natural History Survey of Canada	... Ottawa
Royal Society of Canada	... Montreal

United States.

Academy of Natural Sciences	Davenport
Academy of Natural Sciences	Philadelphia
Academy of Sciences	San Francisco
American Academy of Arts and Sciences ...	... Boston
American Geographical Society	New York
American Philosophical Society	Philadelphia
Bureau of Ethnology	Washington
Colorado Scientific Society	... Denver
Cooper Union for the Advancement of Science and Art	New York
Denison University	... Ohio
John Hopkins University	Baltimore
"Kosmos"	San Francisco
Maryland Historical Society	Baltimore
Natural Academy of Sciences	Washington
Office of Chief of Engineers, U.S. Army ...	Washington
Philosophical Society	Washington
"Science"	New York
Smithsonian Institute	Washington
Society of Natural History	... Boston
Society of Natural Sciences	... Buffalo
United States Geological Survey	Washington

Mexico.

Ministerio de Fomento	... Mexico
Observatorio Meteorologico, Magnetico Central	... Mexico
Observatorio Astronomico National ...	...Tatubaya
Sociedade Cientifica, Antonio Alsate ...	... Mexico
Sociedad de Ingenieros de Jalisco	Guadalajara
Secretaria de Fomento	Guatemala

Argentine Republic.

Academia de Ciencias	... Cordoba
La Museo di Plata	Buenos Ayres

Australia.—Victoria.

"Age"	Melbourne
"Argus"	Melbourne
Athenæum	Melbourne
Astronomical Observatory	Melbourne
Australian Health Society	Melbourne
"Australian Journal of Pharmacy" ...	Melbourne
Chief Secretary's Office	Melbourne